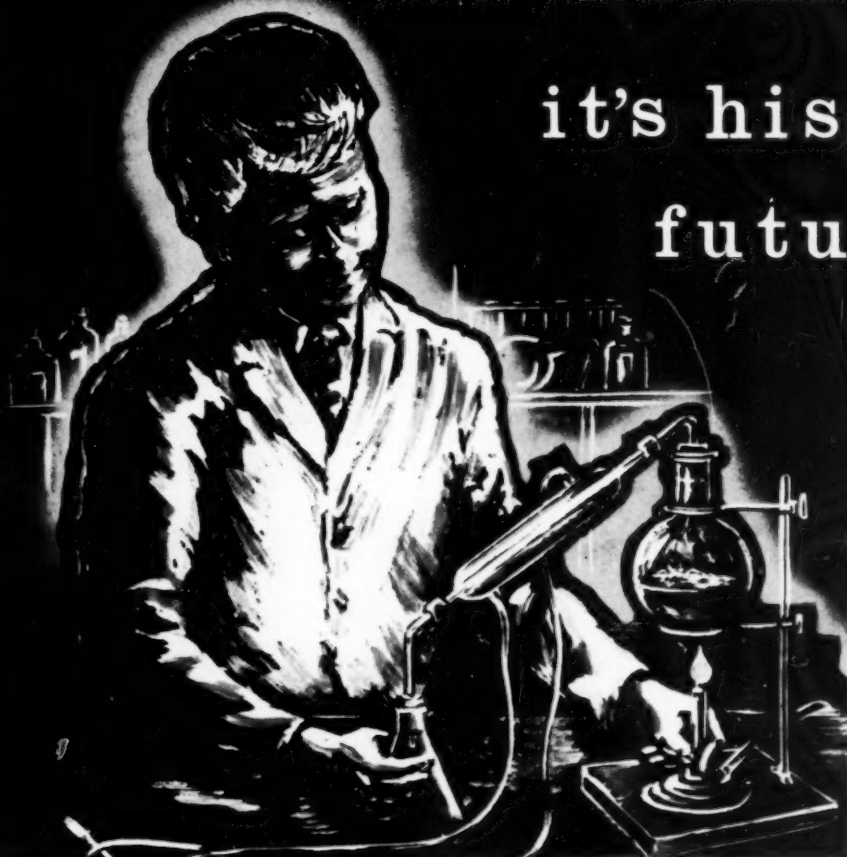


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Vol. 6 No. 64 (New series)

APRIL, 1960



it's his  
future...



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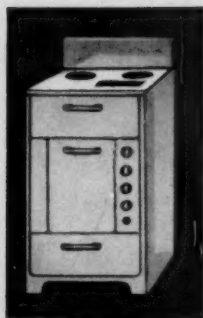
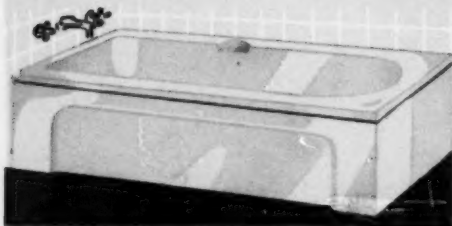
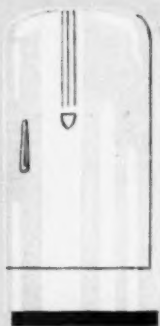
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heat treatment very critical



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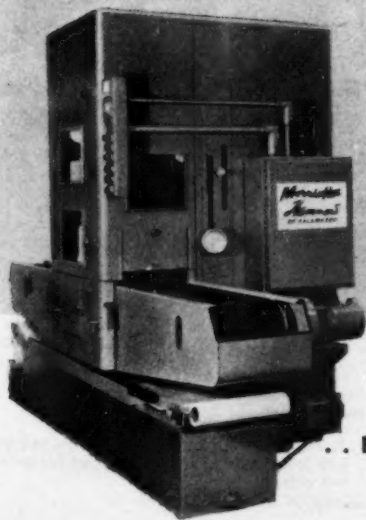
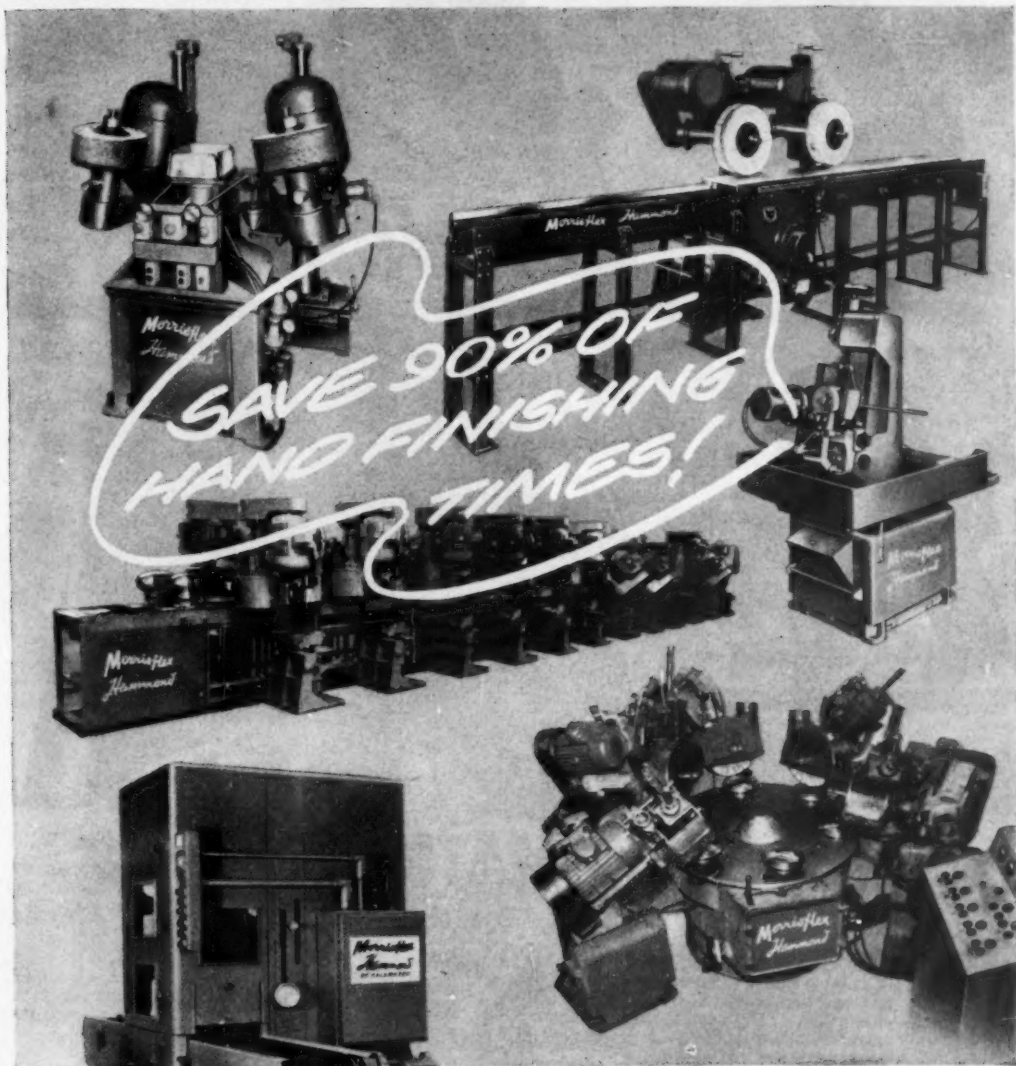
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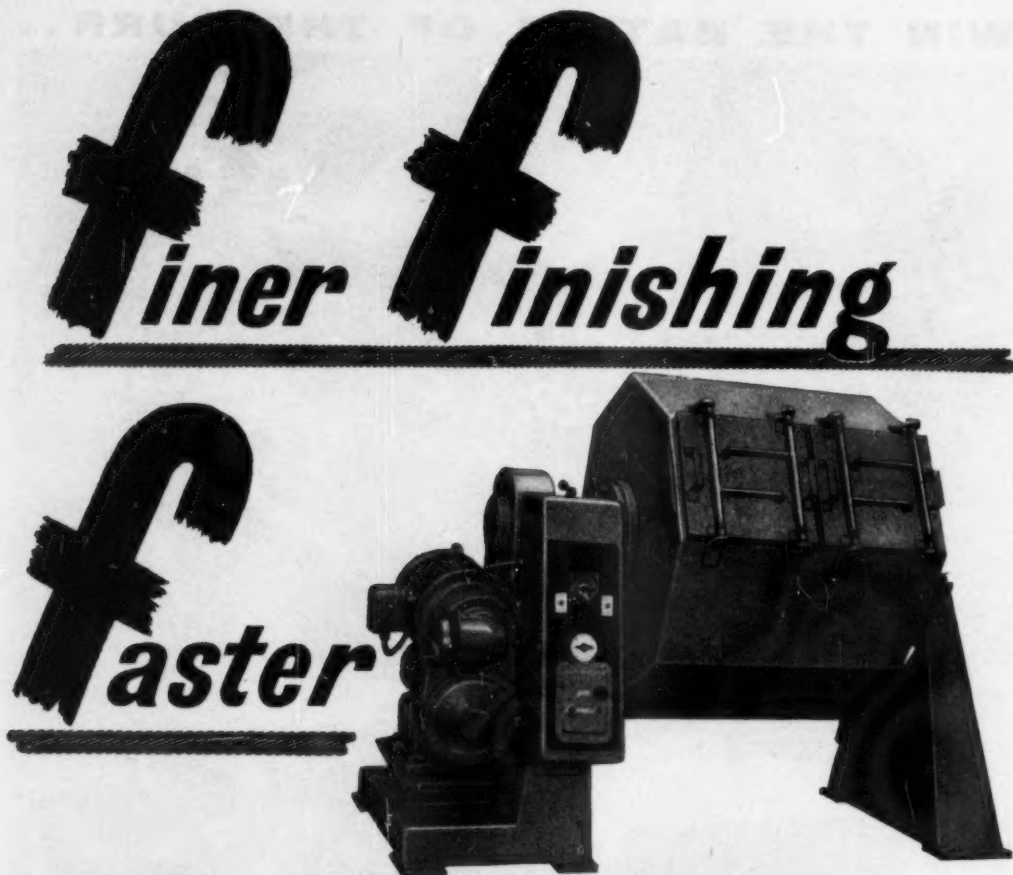
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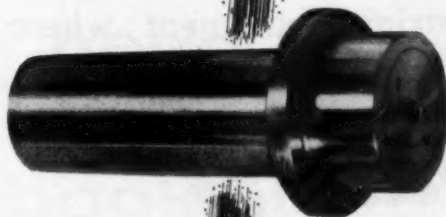
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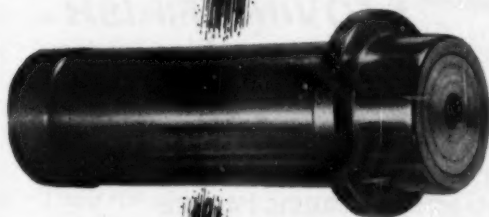




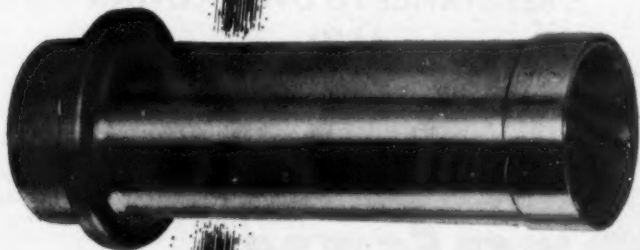
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*we formulate to your individual  
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# As a Plater you need this booklet

If you produce chromium plating you need to be aware of the Mond campaign to increase confidence in plating standards. It's described in detail in this illustrated booklet 'CONFIDENCE IN PLATING'. Here you'll see the press and TV advertising which will back this scheme in your interests. Right through the scheme runs the theme 'Chromium plating *can* be good!'

## Your customers will want to know!

*Do you supply the finished goods?* Customers will be looking for the coloured labels of plating quality which are part of the Mond campaign.

*Do you carry out plating for other people?* They show the special seal of plating standards on your estimates. For this entitles your customer to display the label.

Buyers of cars, household equipment, tools, furniture, and fittings of every type will be looking for plating they can be proud of. Make sure that *you*, as a plater, know all about this new campaign.

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Thames House · Millbank · London · SW1



## A new deal for Chromium Plate

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SCHEME COMPLETE AND RETURN THIS COUPON**



*Please send me your booklet 'CONFIDENCE IN PLATING' with  
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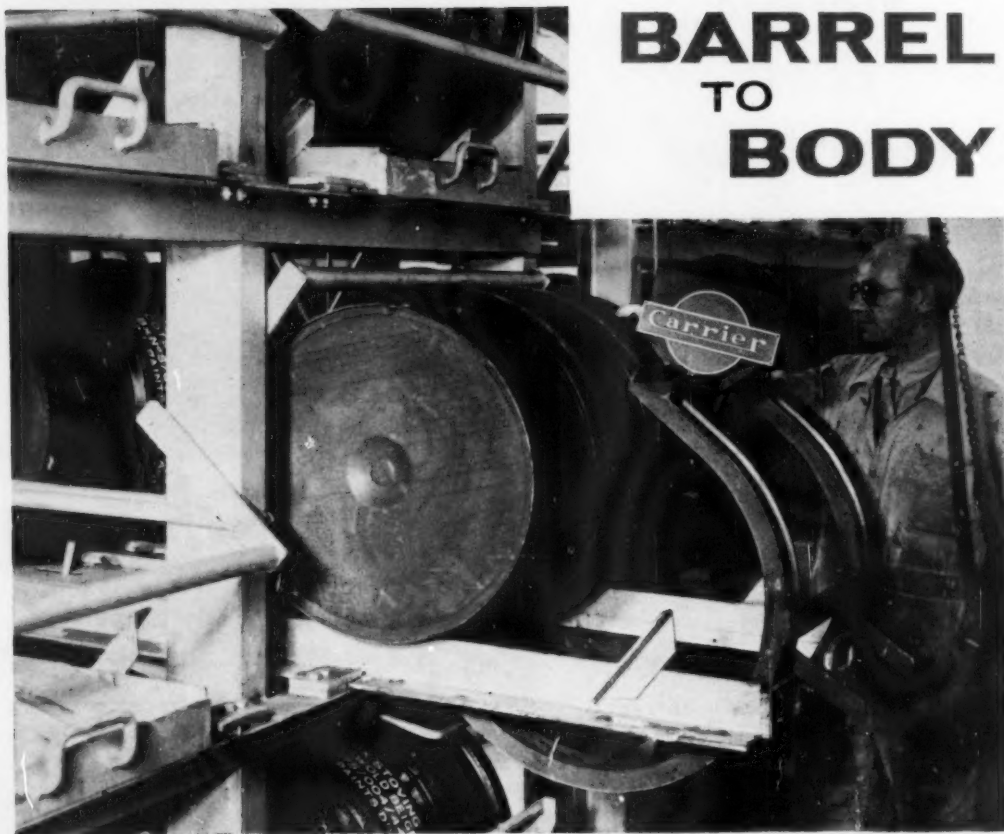
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ADDRESS \_\_\_\_\_

COMPANY AND POSITION \_\_\_\_\_

MF/P1/4

TBA P1A

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PLANT  
FROM**BARREL  
TO  
BODY**

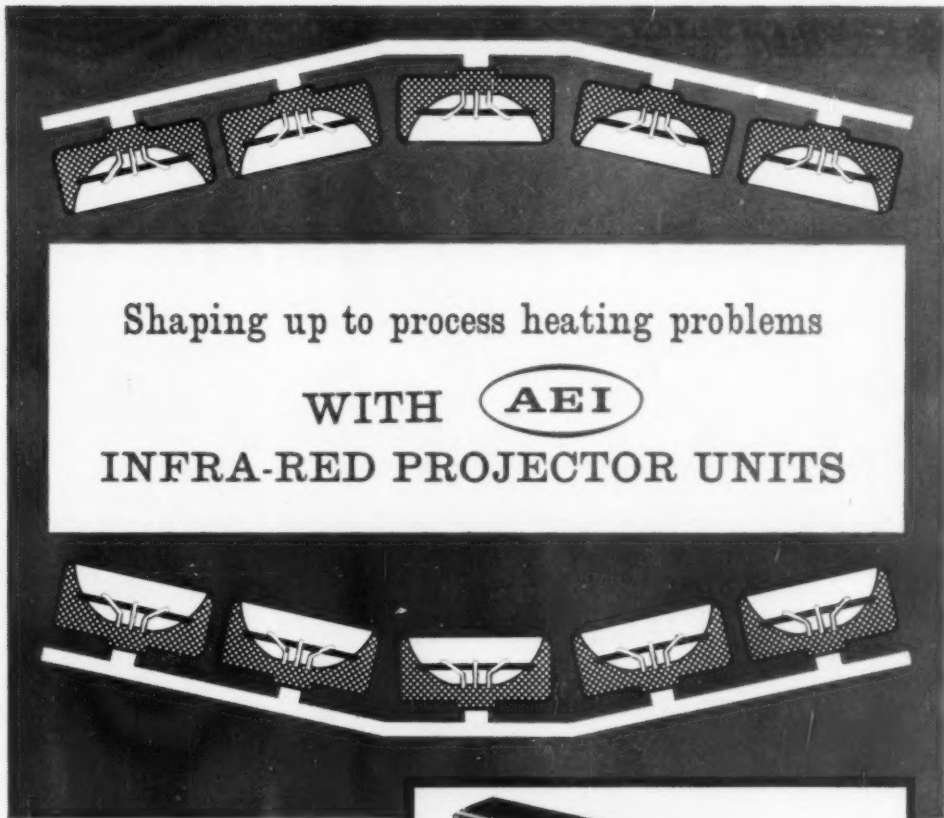
*Further enquiries are invited*

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CARRIER HOUSE, 24, BUCKINGHAM GATE, LONDON, S.W.1.

Here is a drum of paint being removed from a storage rack by a sliding tray which has an automatic stop to ensure that the next drum does not move forward. Carrier Engineering plan and supply complete paint finishing equipment for all industries.

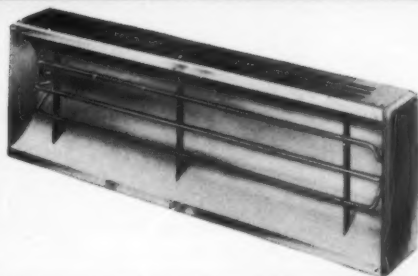
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Shaping up to process heating problems  
**WITH AEI**  
INFRA-RED PROJECTOR UNITS

With these specially designed projector units you can build an electric infra-red plant to suit your processing needs exactly. They incorporate tubular sheathed elements and highly efficient anodised aluminium reflectors, and can be readily erected in banks, portable units or used end to end in continuous troughs. They are eminently suitable for building into existing machines.

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**CANNING**

**ZONAX** *Crack Free CHROME*

Unretouched photograph of hub cap half plated with crack-free and half with ordinary chrome showing difference revealed by corrosion testing.

- ★ **FOR THICKER BRIGHT DEPOSITS**
- ★ **IMPROVED CORROSION RESISTANCE**
- ★ **AND LONGER SERVICE LIFE UNDER ARDUOUS CONDITIONS**

**ORDINARY CHROME**

showing stress cracks which can result in premature failure of nickel coatings.

Section of hub cap photograph enlarged.

**CRACK-FREE CHROME**

completely free from cracks, giving greater protection to the nickel undercoating.

Zonax Crack-Free Chrome solution enables bright chrome deposits having three to four times the conventional thickness to be applied with a complete absence of surface cracking.

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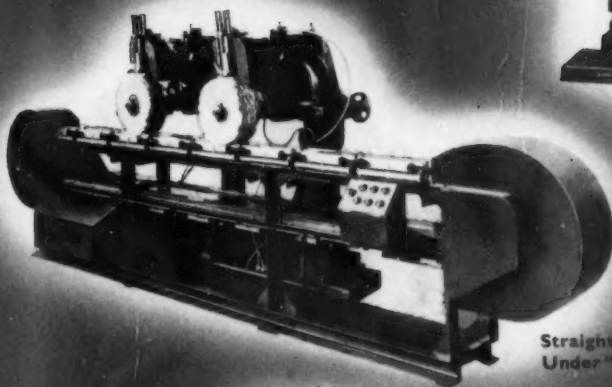
Ask for further details or apply for a demonstration on your components at our new Technical Centre.

**CANNING**

GREAT HAMPTON ST. BIRMINGHAM 18. LONDON & SHEFFIELD



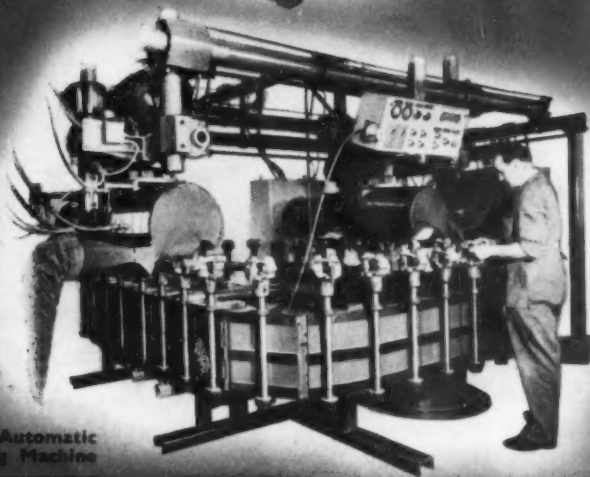
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Rotary Table Indexing Type Polishing Machine



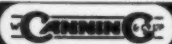
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**with BORON**

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# metal finishing Journal

April, 1960



Vol. 6, No. 64 (New Series)

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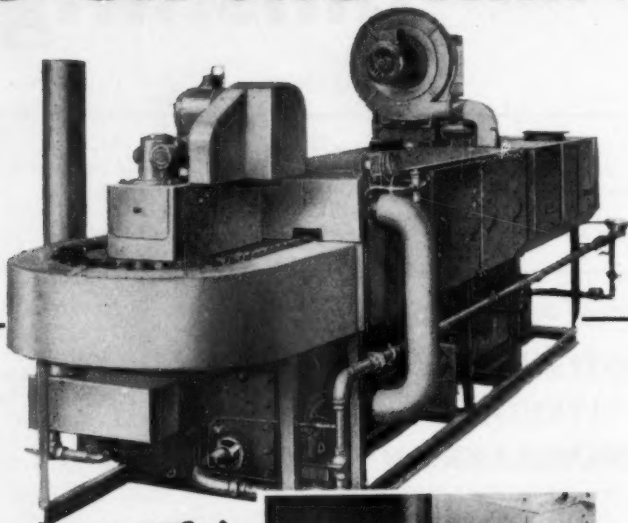
THIS JOURNAL IS DEVOTED TO THE SCIENCE AND TECHNOLOGY OF PAINT APPLICATION, ELECTRODEPOSITION, VITREOUS ENAMELLING, GALVANIZING, ANODIZING, METAL SPRAYING & ALL METAL FINISHING PROCESSES. THE EDITOR IS PREPARED TO CONSIDER FOR PUBLICATION ANY ARTICLE COMING WITHIN THE PURVIEW OF "METAL FINISHING JOURNAL" AND ALL SUCH ARTICLES ACCEPTED WILL BE PAID FOR AT THE USUAL RATES.

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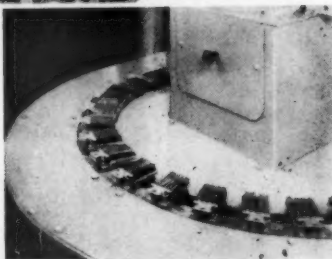
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# Right on the chin!



**Washing THE NEW  
REMINGTON  
ELECTRIC SHAVER HEADS  
prior to plating**



Immediately prior to plating, the New Remington shaver heads are passed through this Dawson machine to remove lapping compound. They are subjected to intense, prolonged jetting treatment to bring them to the highest possible standard of cleanliness followed by a hot air drying treatment. 40,000 shaver heads are handled on each machine in an eight hour day. This is just one more example of the vast range of jobs tackled by Dawson equipment. So whatever your metal cleaning problem get in touch with Drummond-Asquith Limited, at the address below and we will endeavour to arrive at a solution both efficient and economical.

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**LONDON WORKS**, 406, Roding Lane South, Woodford Green, Essex.

Tel: Cleckheaton 3422 (5 lines)  
Tel. Crescent 7777 (4 lines).

## A JAUNDICED VIEW

WE have never carried out any serious or detailed research into the reading habits of subscribers to Metal Finishing Journal. We have assumed that the readership includes a fair proportion of those who seize it the instant that its monthly thud on the doormat greets their ears, rend it from its wrapper and avidly peruse it from cover to cover while their coffee grows chill and the bacon and eggs congeal on the plate. To others it may come as a welcome means of relieving the tedium of the morning journey to work. Among the rest there are the skimmers and the skippers and those who put it by for closer study in a more leisured moment. Among these last must be included a gentleman whose office we had occasion to visit recently against whose desk stood a large bookshelf crammed with some two years' issues of a technical weekly all neatly stacked with their wrappers untorn awaiting the day when he would find the time to devote to studying their contents. We still wonder whether that day has yet arrived for him.

Be that as it may, there must be among our readers one, who having digested the contents of his M.F.J., is in the habit of passing it on for the edification of his wife, for it was a housewife who was so moved by some comments that we made on this page last month that she felt constrained to utter a mild protest.

We had referred in generally approving terms to some of the new schemes afoot for labelling the finishes on certain household articles in order to assist the intending purchaser to select a finish of adequate durability to ensure a reasonable life. Unfortunately, however, to our housewife correspondent, these labels represent just so many more additional complexities in a life which is, for her, too complicated already. The burden of her protest is that although she is (we must assume) a competent housewife, she is being called upon to exercise many of the functions of a chemist and an engineer. Every garment she buys bears a label informing her that it is made of a new textile bearing either a meaningless trade name, or an unpronounceable chemical definition and giving, in minute detail, instructions as to how the material should be washed and ironed (or not ironed) so that on each wash day everything has to be sorted into a vast number of heaps so that the idiosyncrasies of each material can be carefully observed, always assuming of course that the various distinguishing labels have not become detached or mislaid. The general result appears to be to her that most of her washing involves the use of one of the detergents against which she is warned by the manufacturers of her washing machine.

Her final plaint is not without irony. It is all very well, she points out, to laud the virtues of vitreous enamel. Her kitchen boasts a refrigerator, whose shining white enamel surface was her pride and joy, harmonizing as it did with the white stove enamelling on the wall cupboards above it. Alas, the pristine whiteness of the paint has with the passing years mellowed to a rich cream, which in contrast with the unchanged snowy pallor of the enamel looks merely grubby. If only they had all changed colour together the effect would be not displeasing. So what can she do now? Restove all the cupboards at great cost, or sell her white refrigerator and buy a cream one? The suggestion that the application of a sufficient number of labels to one or other of the surfaces would conceal the discrepancy was not kindly received.

# Talking Points

by "PLATELAYER"

TOPICAL COMMENT  
FROM THE MAIN  
LINES AND SIDE  
LINES OF METAL  
FINISHING

## A PLETHORA OF TESTS

**C**RITICISM of the durability of chromium plating has resulted in the proliferation of so many methods of improving it that the poor manufacturer is in a dilemma and does not know which way to turn. Now the same thing has happened to corrosion testing.

For years everyone knew that the salt-spray test was unsatisfactory and misleading, but went on using it just the same, *faute de mieux*. Half-hearted attempts were made to find alternatives, but they never came to everything.

Now, all at once, several alternatives have appeared, each apparently overcoming all the disadvantages of the salt-spray and sponsored by highly expert opinion. So we have the sulphur dioxide test, the copper accelerated-acidified salt-spray test, and the Corrodokote test, to name only the best known ones. So having lost the salt-spray test, no-one knows which of the others to standardize on.

The plater looks at the moment, like being obliged to produce an article which will comply with any or all of these tests (depending on the current whim of each customer), and to have the necessary, often expensive, facilities for carrying them out. Unless, of course, the plater and the customer are one and the same person!

## NO BRAKE ON BREAK-THROUGHS

**T**HE relatively new word, "break-through" was quite expressive when it was first introduced to signify a sharp major advance in science or technology. When applied to such things as supersonic flight and synthetic penicillins it was a very good word indeed. But like everything else it is now being degraded. Many old products in new disguises are now described in terms of a "break-through," and the advent of yet another alkaline powder for indigestion is hailed on television as a "major break-through" in treatment.

As headlines describing "break-throughs" no longer stir us, some-one will have to think of a yet more powerful word. The whole thing is reminiscent rather of the degradation of the superlatives by Hollywood, which reached its nadir when one film tycoon asked another how business was going. "Colossal!" came the reply. Whereupon his friend answered, "Never mind, it will soon pick up."

## POINT COUNTER POINT

**T**HERE is nothing like attack as the best means of defence and it is interesting in comparing advertisements for competitive products in the finishing field and elsewhere to see how a criticism of one system may appear as a bull point in another.

Take the case of some well-known automatic plating machines which claim, as an apparently fairly obvious advantage, that all the operating mechanism is above tank level. This means that maintenance is rendered easier because of improved accessibility. Faced with the possibility that potential customers may look askance at his plants in which the mechanism is differently located, an American manufacturer takes the initiative and proclaims in his advertisements:—

"No Extra Headroom Required. All elevating mechanism operates below top of rack carrier."

Another example is a current advertisement for an electrocleaner which produces a foam. It is known that foams can sometimes retain gases and cause slight explosions, but any worries the user may have are allayed by the statement:—

"It provides a light foam blanket that is right for all electrocleaning operations—eliminates explosion possibilities, yet retains fumes."

How a foam can eliminate explosion possibilities is not explained.

A basic theorem in applied mathematics is that to every action there is an equal and opposite reaction. Is it perhaps not possible that, by the same token, to every advantage there is an equal and opposite disadvantage? It is not usually very difficult to think of one, especially when commercial considerations are involved!

## THE REASON WHY

**M**EN meet together for many reasons in the course of business. They need to instruct or persuade each other. They must agree on a course of action. They find thinking in public more productive or less painful than thinking in private.

Meetings are held because men seek companionship, or at a minimum wish to escape the tedium of solitary duties. They yearn for the prestige which accrues to the man who presides over meetings, and this leads them to convoke assemblages over which they can preside."

J. K. GALBRAITH

# ZINC COATINGS ON IRON AND STEEL

## 5 - Design Considerations

### A Survey

by A. K. PARKER, M.A.

in collaboration with the Zinc Development Association

(Continued from page 48, February, 1960 issue)

THE figures quoted in Chapter 1 should have left the reader in no doubt as to the importance of preventing corrosion from shortening the service life, and ultimately destroying, iron and steel goods and structures of all sorts. Yet it is surprising how often equipment is designed without any account being taken of the measures that will be needed to protect it in service. So often, the question of choosing a suitable protective system comes as an afterthought to the main production process rather than as an integral part of the design. The adoption of such an attitude will almost certainly increase the difficulties, and hence the cost, of applying a protective system and may also reduce its effectiveness on account of poor design, either of a single component or of a whole structure. It cannot therefore be too strongly stressed that the protective system should be regarded as an integral part of any item made from iron and steel and one that should certainly be considered at the design stage.

Hudson<sup>(1)</sup> has drawn attention to the need for making a reasonable allocation for the cost of the protective coating when estimating for a new structure or piece of equipment. Otherwise enforced economy in the final stages of construction may lead to the adoption of an inferior protective system, thus jeopardizing the usefulness of the whole assembly.

#### DESIGN FEATURES WHICH AFFECT THE APPLICATION OF A ZINC COATING

The general advantages and limitations of each of the zinc-coating processes were mentioned in Chapter 2 and, in most instances, considerations such as size, shape, complexity and cost will be sufficient to guide manufacturers in choosing the most suitable process for a particular application. Here various details of the design will be discussed which will simplify the application of the chosen coating; occasionally, of course, it may be found

that these considerations make it desirable to modify the original choice of zinc coating process, which is a further reason for examining these questions at the drawing-board stage.

#### Hot-dip Galvanizing

Design considerations which affect the application of hot-dip galvanized coatings arise in two principal ways: first, from the limitations of the pickling process used for the initial surface preparation and, second, from the sudden temperature change which occurs when the steel is dipped into the molten zinc bath.

Cavities which have only small openings should always be avoided as pickling solution and washing water will penetrate into them and probably remain there. This will certainly lead to rapid attack of the metal and may also constitute a serious source of danger during the galvanizing process as the sudden heating will cause steam to be generated which, being unable to escape rapidly, will develop a very high pressure with consequent danger of explosion. The same risk arises in sealed cavities because a pinhole in the welding is enough to allow water or pickling solution to seep into them.

The venting of tube assemblies involves similar problems and it is essential to discuss them with the galvanizer in advance. Internally open-mitred joints should be used at all times to avoid sealed sections.

**Contacting Surfaces.** Oil or grease should be removed from between contacting surfaces before assembly as they will prevent the zinc from penetrating in between the surfaces and will "boil out" and spoil the galvanizing. Often it is advisable to seal the edges of such contacting surfaces by welding, though it is vitally important to see that no sealed cavities are formed in this way—the surfaces must be in close contact at all points.



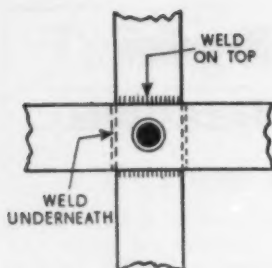


Fig. 28. (left)—A.S.T.M. A 385-55T recommends that all contacting surfaces should be completely sealed by welding.

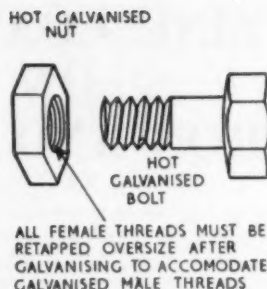


Fig. 29. (right)—Recommended practice for galvanized nuts and bolts in A.S.T.M. A 385-55T.

**Movable Parts.** Sufficient clearance must be allowed to permit free movement of movable parts, such as drop handles on dustbins, etc., after the zinc has been applied. A clearance of  $1/32$  in. is generally sufficient for this purpose.

**Threads.** A clearance must also be allowed on both male and female threads to allow for the thickness of the coating. It is usually advisable to retap galvanized screw threads after applying the coating so as to ensure a smooth fit.

**Assemblies of Different Materials.** If an assembly contains both old and new steel or is a combination of castings and rolled steel, the surface preparation will be difficult because the pickling times of the various materials will differ. Such assemblies can be prepared for galvanizing by shot blasting, which is the usual method of preparing articles for zinc spraying. Again, if some surfaces have been machined, these will require a far shorter pickling time than those which have not. In such cases, the entire article should be blast cleaned and then pickled for a shorter time than usual.

**Labels and Paint.** Oil, grease and paint are not removed by normal pickling so special steps should be taken to eliminate them before an article is sent to be hot-dip galvanized. It is therefore advisable to order tubes and other raw materials free from ordinary paint, varnish, oil and synthetic coatings or identification marks and to use only water-soluble paints for temporary markings. Where permanent identification is required, marking in punched or embossed letters is necessary.

**Welding Slag** resulting from the use of a coated welding rod is another material which is not removed by normal pickling. If it is not possible to use an uncoated rod, the slag should be removed mechanically before the article is sent to the galvanizer.

**Warping and Distortion** may occur when welded or riveted assemblies or large pieces of sheet are hot-dip galvanized after fabrication.<sup>(2)</sup> Such distortion is rarely serious and is usually rectified by the galvanizer. It occurs when the assembly is unevenly heated on immersion in the galvanizing bath and is more likely to occur with large articles

which may have to be dipped more than once to cover the surface completely.

Warping is accentuated by the use of non-symmetrical sections such as channels and angles and rarely occurs in sections, such as I-beams or tubes, which are symmetrical about both major axes. There is less risk of distortion in sheet metal if all bends are made to a wide radius and if the introduction of stresses is avoided during fabrication. It is also desirable to make section thicknesses as uniform as possible, both in articles fabricated from sheet metal and in castings as this will minimize any tendency to fracture or distort caused by unequal heating during galvanizing.

**Embrittlement.** Occasionally, a material which has previously undergone severe localized cold working may exhibit some loss of ductility when it is immersed in the galvanizing bath. This can be avoided by suitably annealing or stress-relieving the steel before galvanizing. Galvanizing embrittlement, as the phenomenon is called, only occurs in thick sections and is said to be less prone to occur in steels manufactured by the open-hearth process than by the Bessemer process. Tests for embrittlement have been published by a committee of the American Society for Testing Materials.<sup>(3)</sup>

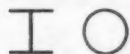
**Zinc Plating.** As acid pickling is the normal method of preparation for articles which are to be zinc plated, the difficulties caused by assemblies of different materials and the presence of labels, paint or welding slag have still to be overcome. The remarks under those headings (see Chapter 2) therefore apply.

**Sherardizing.** The remarks under the headings *Assemblies of Different Materials*, *Labels and Paint* and *Welding Slag*, are equally applicable to the pickling operation which is also a commonly used method of surface preparation for articles to be sherardized.

**Cavities**, with small openings are a source of danger during sherardizing, as water or pickling acid may find their way into them and lead to hydrogen formation with the possibility of an explosion when the drum is heated with the zinc dust.



SYMMETRICAL SECTIONS



UNSYMMETRICAL SECTIONS

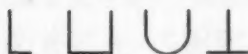


Fig. 30.—Symmetrical and unsymmetrical sections

### DESIGN FEATURES WHICH AFFECT THE LIFE OF A ZINC COATING

Ideally, of course, articles should be so designed that the corrosive attack never gets a chance to obtain a foothold and begin its destructive work.

Cleanness of design is important. All features that facilitate the lodgement of moisture and atmospheric grime should be avoided as these remain damp long after the rest of the structure has dried. Moisture plays a big part in the corrosive attack and, if it can be removed as rapidly as possible from the zinc-coated surface, the life of the coating will be increased. Nooks, crannies and horizontal ledges should therefore be avoided and, for the same reason, butt welds are to be preferred to lap joints. Where such features are essential they should be designed so that water runs off them and is not retained on the surface. Again, rounded corners are preferable to sharp ones, both on exterior surfaces and inside liquid containers, etc.

Since corrosive attack is largely electrochemical in nature, it may be intensified by the currents flowing between any two different metals forming a circuit through an electrolyte (see Chapter 1). Such contacts between dissimilar metals are likely to occur where brackets, bolts and rivets are incorporated in an assembly made from another material; weld metal may have the same effect. In practice, it is found that copper and its alloys are the only materials likely to cause trouble when placed in contact with a zinc coating. Damage can also result when the two metals are not directly in contact through the electrolyte, as for instance when water from copper roofs drains into hot-dip galvanized gutters or in hot-water systems which incorporate copper piping and a hot-dip galvanized storage tank (see Chapter 3), provided the more electropositive metal (copper) dissolves in the electrolyte.

Unless the initial zinc coating is expected to have a life at least as long as that required of the underlying structure, some renovation will eventually be necessary. It is therefore essential to provide adequate access to all exposed surfaces. Unless this is done, corrosion will be rapid once the zinc coating has reached the end of its useful life and there will be no simple way of retarding it. As an example, steel joists ought always to be placed sufficiently far apart so that their inner surfaces can be reached with a paint brush. Again, storage

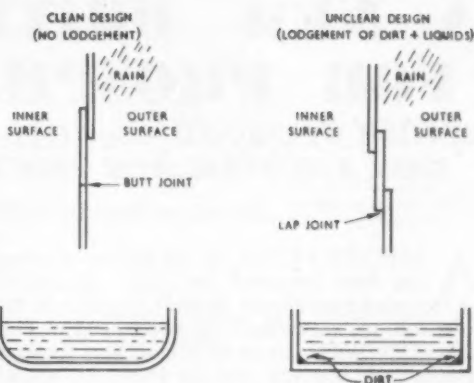


Fig. 31—Diagram illustrating clean and unclean design

tanks are best placed on legs so that their underneath surfaces are accessible and so that moisture and dirt can be removed from time to time.

In buildings, zinc-coated steelwork is sometimes embedded in damp lime mortar or other exceptionally corrosive materials. Where such contacts cannot be avoided, a thick coat of suitable bituminous paint or mastic asphalt is usually applied between them.<sup>(4)</sup>

### Welding Zinc-coated Materials

Welding is very often employed in the fabrication of articles made from sheet, strip, tube or girders which have been zinc coated by a continuous process. Although it is not difficult to weld through the zinc coating, rather objectionable fumes are given off and in an enclosed space it is necessary to protect the worker from their effects. Welds in zinc-coated steel have satisfactory strength and Admiralty tests on the use of hot-dip galvanized steel plates for the hulls of welded ships have yielded good results.<sup>(5)</sup>

When welded joints are to be made in steel which is first to be zinc sprayed, it is quite easy to mask the steel at the location of the joints and to touch these parts up after welding. Alternatively, the zinc coating may be ground off where the welds are to be made.

Since zinc begins to boil at about 900°C., it is inevitable that much of the zinc coating will be burnt off in the immediate neighbourhood of the welding torch or electrodes when ordinary gas fusion welding or electric-arc techniques are employed. It is therefore advisable that such joints should be touched up by zinc spraying or by coating them with a zinc-rich paint to provide complete corrosion protection.

When oxyacetylene bronze welding<sup>(6)</sup> is used,

(Continued in page 150)

# A NEW BRITISH STANDARD FOR PHOSPHATE COATINGS

## BRITISH STANDARD 3189: 1959 — "PHOSPHATE TREATMENT OF IRON AND STEEL FOR PROTECTION AGAINST CORROSION"

*Specially reviewed for METAL FINISHING JOURNAL*

A SPECIFICATION for phosphate coatings has been advocated for years, particularly by the more scientifically inclined members of the corrosion and metal-finishing worlds, and at long last the first British Standard covering the phosphate treatment of iron and steel for protection against corrosion has appeared.

As long ago as 1944—the early days of the prefabricated house and the kitchen-bathroom unit—the Ministry of Works requested the British Standards Institution to draw up a specification for phosphate coatings as a basis for painting steel and a Committee was appointed. The outcome of their deliberations was the British Standards Institution publication PD 539 dated August 1946—"Recommendations for Phosphate Coatings as a Basis for Painting Steel"—in which attention was first drawn to the difficulties associated with attempts to compile such a specification. In fact the recommendations state "although phosphating processes have been operated industrially for the past 20 years or more, sufficient published data on the physical and other properties of phosphate coatings was not available in the scientific literature to permit of the immediate compilation of performance specifications."

In essentials, the recommendations of PD 539 were that phosphated steel surfaces intended for the reception of paint should be matt without excessive crystalline appearance and free from untreated patches and flaky or uneven deposits. Recommended tests to demonstrate the presence of a phosphate coating were scraping once with a blunt knife; scraping a small area lightly with a sharp blade and rubbing with fine steel wool (grade 000). In addition, the basic steps in the best phosphating practice were briefly outlined. An amendment was published in July 1948 regarding the effects of rinsing.

Now nearly 14 years later a British Standard Specification B.S. 3189:1959 has been issued superseding PD 539. It is limited to treatments for the protection of iron and steel against corrosion, does not cover the more specialised requirements of the Services or phosphate passivation treatments such as "panel washes" which consist essentially of phosphoric acid. In the intervening period, however, between the issue of PD 539

and B.S. 3189, to meet Ministry and Service requirements the Ministry of Defence issued Defence Specification DEF-29 "Phosphate Treatment of Iron and Steel for Protection Against Corrosion," dated December 1956, and it is interesting to compare the requirements of Defence Specification DEF-29 and this latest B.S. Specification.

### Classes of Coating

Section one of the British Standard covers five classes of unaccelerated and accelerated processes which are designated in terms of the composition and weights of the coatings as compared with three classes in DEF-29. These are summarized and generally compared in Table I.

#### Class A1. Heavyweight

This class covers processes giving coatings consisting essentially of manganese and/or iron phosphate and having a coating weight of not less than 700 mg. per sq. ft. They are normally used where maximum protection is desired, particularly under oils or greases. It is identical with Class I of DEF-29 except that in the Defence Specification it is pointed out that these processes are normally used where heavy or deep phosphating is required for bearing or sliding surfaces or where maximum protection is required, particularly with oils or greases.

#### Class A2. Heavyweight

This class, which has no counterpart in DEF-29, covers coatings that consist essentially of zinc phosphate and have a weight of not less than 700 mg. per sq. ft. They are normally used for the same purpose as Class A1 where a good degree of protection is required, coupled with a more rapid degree of processing.

These processes, even though they may produce a phosphate coating weight of greater than 700 mg. per sq. ft. do not meet the requirements of Class I of the DEF Specification because they are based on zinc phosphate and not manganese and/or iron phosphate.

It is probably true that manganese phosphate coatings afford a slightly higher corrosion protection than zinc phosphate coatings of comparable coating

Table I

Comparison of Phosphate Coating Specifications in B.S. 3189 : 1959 and DEF-29.

B.S. 3189 : 1959 *				DEF-29			
Class	Type of Phosphate coating	Coating weight mg./sq. ft.	Comments	Class	Type of Phosphate coating	Coating weight mg./sq. ft.	Comments
A1 Heavyweight	Essentially manganese and/or iron	≥ 700	Normally used where maximum protection is desired particularly under oil or grease	I	Essentially Mn and/or Fe	≥ 700	Used for bearing or sliding surfaces or where maximum protection is required*
A2 Heavyweight	Essentially zinc phosphate	≥ 700	Similar applications to Class A1 but where some rapid processing coupled with good protection is desired				
B Medium weight	Essentially zinc or other metal phosphates	≥ 400	Normally used for general protective purposes under paint coatings and under oils or greases for less severe duty than Class A1 and A2**	II	Essentially zinc or other inorganic phosphates	≥ 400	Normally used for general protective purposes under paint and for less severe duty than Class I with oil. Includes most immersion type accelerated processes. Generally a Class I process may be used when Class II is called for
C Lightweight	Zinc or other metal phosphates	100-400	Essentially a pretreatment for painting for light gauge steel. Includes most of the spray type accelerated zinc phosphate processes	III	Essentially inorganic	≥ 150	Normally only used for the pretreatment of light gauge steel sections under paint, varnish or lacquer coatings of high protective value
D Extra Lightweight	Essentially iron phosphate	30-100	Used for the same purposes as Class C and includes most of the spray type alkali-metal phosphate processes		Special approval	50-150	Where thin section components are fabricated or formed after the application of paint, varnish or lacquer, the phosphate coating may, with the approval of the Inspection Authority, be reduced to within the range 50-150 mg. per sq. ft. of treated surface

\* DEF-29 points out that this Class includes normal non-accelerated processes (except those based on zinc phosphate) and certain accelerated processes.

\*\* B.S. 3189 stresses that when these processes are used on light-gauge sheet under a hard paint-type coating, it is advisable to limit the coating weight to not more than 700 mg./sq. ft. to prevent excessive paint flaking after damage by denting in service.

weight. On the other hand, however, heavyweight processes based on zinc phosphate have found extensive general industrial applications because they are more economical, requiring lower operating temperatures, less processing time and have a lower chemical consumption. These advantages more than off-set the slightly reduced corrosion protection as compared with manganese phosphate and from the general industrial standpoint, as compared with the sometimes more exacting Service requirements, it is a good thing that a place has been found in Class A for these widely employed processes.

#### Class B. Medium weight

Processes giving coatings consisting essentially of zinc or other metal phosphates and having a coating weight of not less than 400 mg. per sq. ft. are included in Class B. They are normally used for general protective purposes under paint and for less severe duty than Class A1 and A2 processes

under oils or greases. They correspond with those of Class II of DEF-29, which points out that this group includes most immersion-type accelerated processes.

#### Class C. Lightweight

Industrially, this is by far the most important Class for the mass-production pretreatment of light gauge steel before painting and it covers processes giving coatings that consist essentially of zinc or other metal phosphate and have a weight of 100 to 400 mg. per sq. ft.

The specification states that it includes most of the spray type accelerated zinc phosphate processes but due to very recent developments, it also includes many of the newer immersion processes and techniques. There is a fast growing demand for fine, smooth, tightly adherent zinc phosphate coatings as a base for painting and these are being achieved by the use of activating dips; special cleaners and pre-rinses; and probably most important of all

by the use of special activating agents and accelerators in the phosphating baths.

When pretreating such articles as refrigerators, washing machines, motor cars, etc., the composition and quality of the coating are virtually important. Too heavy a coating will result in poor behaviour when the painted metal is bent or damaged whereas too low a coating results in inadequate corrosion protection. For these reasons the specifications of definite upper and lower limits of coating weight will be welcomed by industry.

The mass production painting of light gauge steel is principally a general industrial rather than a Service application hence it is not surprising to find that the Class C-lightweight and the Class D-extra lightweight (discussed below) both fall within the requirements of Class III in DEF-29. This covers processes giving coatings consisting essentially of inorganic phosphates and having a coating weight of not less than 0.15 gm. per sq. ft. but with no upper limit and normally used for the pretreatment of light-gauge steel sections. It states, however, that where thin section components are fabricated or formed after the application of paint, varnish or lacquer, the phosphate coatings may, with the approval of the Inspection Authority, be reduced within the range 50 to 150 mg. per sq. ft. Thus unless this special dispensation is obtained, some of the newer spray-phosphating processes based on zinc phosphate and currently in production use would not be considered as Class III because they produce coating weights within the range 100 to 150 mg. per sq. ft.

#### Class D. Extra lightweight

This comprises processes giving coatings that consist essentially of iron phosphate and have a weight of 30 to 100 mg. per sq. ft. It includes most of the spray type alkali-metal phosphate processes and in essentials has for industrial purposes made quite a separate class of the processes

for which special approval is required under Class III in DEF-29. This seems a sensible thing to do as these Class D extra lightweight coatings are now firmly established and are usually operated in conventional 6 or 4-stage spray plants. As they combine both cleaning and coating properties, on 4-stage plants the first two zones take care of the cleaning and passivation, the remaining two being water rinsing and a final "chromate" rinse. They are particularly valuable where a single coat paint finish is to be applied and where the Service conditions are not particularly exacting. Typical applications are for steel furniture and toys.

#### Processing Requirements

In both Specifications, after first defining the various Classes of coating (Section One) there follow definitions of such terms as "unaccelerated process," "accelerated process," "pointage," etc. followed by Section Two—Processing Requirements. Here, as one would expect, the requirements of B.S. 3189 and DEF-29 are very similar except for one or two points.

The British Standard states quite categorically "when the phosphated material is subsequently to be painted, it shall not be allowed to dry between consecutive stages after wetting in aqueous solutions"—the very best practice—and on many automatic plants "wetting sprays" are installed to take care of this point. This is rather more specific than the DEF requirement "Consecutive stages shall follow one another without delay."

The requirements regarding rinsing after phosphating are summarized in Table II. Here the Defence Specification is more exacting than the British Standard. Unaccelerated processes must have one rinse; accelerated processes must have three rinses. Chromic acid rinses must be used hot and the minimum temperature of hot water rinses is specified. On the other hand, the British Standard approves for unaccelerated processes—

(Continued in page 150)

Table II

Comparison of Specified Rinsing Treatments after Phosphating.

Unaccelerated Processes		Accelerated Processes	
B.S. 3189 : 1959	DEF-29	B.S. 3189 : 1959	DEF-29
(1) Cold Water or Hot Water then (optional) Dilute "chromate" solution or NO RINSE (1)	(1) Cold Water or Hot Water or Hot dilute "chromic" solution	(1) Running Water then Dilute chromate (11) solution or Running Water	1. Flowing Cold Water then 2. Hot Water > 167°F. then 3. Hot dilute "chromic" solution
I.e. ONE RINSE but can be None (1) or Two rinses	I.e. ONE RINSE	Summary	
		I.e. TWO RINSES but ONE if water stain is used	I.e. THREE RINSES

(1) Rinsing may be dispensed with, by agreement, in the cases of free-draining articles that contain neither pockets nor crevices and are to be sealed with an oil or non-drying coating.

(11) Where a water-soluble stain is to be applied a chromate rinse is unnecessary.



# THE INSTITUTE OF VITREOUS ENAMELLERS

## Silver Jubilee Conference 1959

## Report of Technical Sessions

(Continued from page 87, March 1960 issue).

Abstract No. 7

### METHODS OF DECORATION IN THE CERAMIC INDUSTRY

by Dr. W. L. German\*

#### Methods of Decoration Used in the Ceramic Industries.

VITREOUS enamelling is mainly concerned with the production of articles in one colour although the hand-painted Battersea enamels are an example of one of the early forms of decoration employed. However, with the exception of the sign trade very little work appears to be done with the application of designs to enamelled surfaces and, as there is no reason why this state of affairs should continue, a survey of the methods available for applying decoration to ceramic ware might prove advantageous. The processes available are as follows :—

- a) hand painting
- b) printing
- c) spraying
- d) mottling and marbling
- e) transferring
- f) silk-screen methods

Hand painting needs only a brief mention ; an ancient craft, it is only useful either as a means of making individual pieces of high value, or where only a few pieces are to be decorated. The ceramic colours have a flux and a suitable oily medium added and the design painted on the fired cover coat. A final fire is given to burn off the oil and fix the colour on to the enamel.

#### Printing

John Sadler and Guy Green are supposed to have perfected the art of printing on pottery around 1750 and even Josiah Wedgwood was sending ware to them in Liverpool to be decorated.

\*Head of Ceramic Dept., Staffordshire Technical College

The process of transfer printing, introduced by William Adams in 1775, is still used today. It involves engraving the design on a copper plate and rubbing a suitably oily colour medium into it, which is left in the depressions of the pattern when the surface is cleaned off. A print is then taken on thin paper or gelatine and rubbed into contact with the ware. Engraved copper plates are used for small runs and impressions taken by hand, but for large quantities, engraved rollers are used and fed automatically with the colour. The prints are taken off on a rotary press and cut into strips of convenient length which are applied to the ware by hand or mechanically. A more recent device is the Murray printing machine, described in detail by N. Pearce (*Transactions British Ceramic Society* 57, p. 527, 1958), in which the colour is applied cold and the sharp definition maintained by varying the colour/medium ratio by additions of aluminium stearate. The machine is powered by compressed air and the pattern is first engraved on a copper plate, chromium plated to increase its life, and the colour offset to the ware with a gelatine pad, suitably shaped by melting the gelatine and pouring it into a mould. The engraving is inked and excess colour removed by a scraper. The pad runs over the plate and moves over to the article and impresses the pattern on to it, while the engraving is being recharged with colour. The ware is automatically centred so that the print appears in the same place, thus minimizing the manual control necessary. Outputs of about 1200 pieces a day have been achieved with one operative, and it has been estimated that the Murray machine has cut the printing costs of the paper transfer method by two thirds. Engravings and pads can be changed rapidly and the only difficulty encountered at present is the printing of holloware. The modified machine can, however, print a pattern on the face and the makers badge on the reverse side.

#### Lithography

Alois Senefelder published a book in 1818 describing the process which is based on the following facts :—



1. finely polished calcareous stones will absorb grease;
2. the grease on the stone will attract printing ink and repel water;
3. water will penetrate the parts of the stone not containing grease and those parts will not take printing ink;
4. a paper pressed into contact with the stone will take up an impression of the design previously drawn on it in the greasy medium.

Briefly, then, a design is drawn in lithographic ink or crayon on a stone, wetted and rolled up with a roller impregnated with a colour, which only sticks to the lithographic ink. A piece of paper is then pressed into contact with the stone and takes an impression of the design. Nowadays grained zinc plates are used in preference to litho stones.

In making a coloured transfer the original coloured drawing is first submitted to the printer for costing. He has to consider, among other things, the number of colours to be used, and this may be as many as twelve. A plate is made for each colour and the component parts drawn together on one big sheet and printed in the colours required. In many cases it is not possible to print direct with the colours made up in oil. Instead an impression is printed on the paper in a greasy medium and the ceramic powder dusted on afterwards. The process is repeated for each colour in turn and care taken to ensure that each of the patterns registers absolutely in printing; the process is effected in air-conditioned rooms to reduce the effect of temperature and humidity on the paper. Photography has taken much of the laborious work out of lithography and F. Dearden has given an outline of this (*Trans. Brit. Ceram. Soc.*, 43, p. 68, 1943). The various parts of the design are photographed through filters which transmit only monochromatic light and a number of plates are made using a panchromatic emulsion. Prints are then made on to zinc plates which are coated with a light-sensitive emulsion consisting of gelatine with potassium di-chromate dissolved in it. The sensitized metal plate is then exposed behind the negative, using a powerful arc lamp as a light source. The surface is coated with litho ink in the required colour and the parts of the emulsion exposed to the light are hardened and the rest dissolved away by treating with warm water, leaving a positive in the appropriate colour. Copper plates can be etched in a similar manner, the positive protecting the metal from the action of the etching liquid.

Lithographs are a quick method of applying decoration. In the modern 'overcoat' litho, the pattern is printed on thin pieces of plastic and attached to paper sheets for easy storage. The plastic sheets can be slid off the paper after standing

in water and squeezed on to the ware. No size is necessary and the plastic is strong enough to be applied to curved or fluted surfaces. An unskilled operator can be trained to do this in about 20 minutes.

The Milford-Astor machine, described in *Pottery Gazette*, 83, p. 853, 1958, can be used for the production of simple lithos with no colour graduations and in only four colours. An inexpensive machine, its main advantage is that it enables transfers and samples to be produced in a few weeks. The process involves making a die of the pattern in metal by a photo etching process and the ceramic colour supplied on foil. The transfer paper and the foil are pressed together, like making a carbon copy, with a separate die press for each colour. Emphasis is again placed on printing each colour accurately on the transfer paper. The finished litho can then be applied to the ware in the usual way.

#### Silk-screen Methods

Transfers can also be prepared by a silk-screen process, or the pattern itself applied to the ware by a silk screen. The process involves using a silk or fine-wire mesh with some of the meshes blocked and others free to transmit the colour. The pattern on the screen can be produced photographically by coating the mesh with a gumbichromate mixture, exposing behind a negative and developing in water as before, or a sensitive material can be purchased in the form of films which are clamped together after processing in the wire-mesh frames. In both cases a separate screen is necessary for each colour and they can be printed on the transfer paper or ware, taking care to see that registration is exact. This process is used for producing simple designs on ware and it enables thicker deposits of colour to be applied than is possible with a lithograph. Elaborate designs are usually prepared by experts.

#### Spraying, Lining, Banding and Stamping

The fashion of two-tone effects has led to the introduction of machines which mask one part of the ware while the other is sprayed, particularly familiar in the iron enamelling trade. One of these machines, described by M. W. Abberly (*Trans. Brit. Ceram. Soc.*, 57, p. 39, 1958), is widely used for spraying clayware. A semi-automatic process, in which a spray-gun, operated by compressed air is used for spraying, either wide or narrow borders and operates at about eight pieces a minute. Automatic centring is a feature of the process and an inclined face plate, held by vacuum is rotated and sprayed with colour over the stencil onto the border. The cycle of operations is completed by the stopping of the spray, the retraction of the stencil and the release

of the article. Holloware can be sprayed and any surplus colour and overspray drained off and used again.

Lining is done mechanically. A Canadian machine, the Ryckman, now made under licence in this country, is used for applying ceramic and liquid gold, with three times the output expected from a hand worker. It consists of a turntable and synthetic rubber rollers on arms, which ride around the edge of the ware. The arms also have a store of colour and keep the rollers charged. The type of line can be altered by selecting a different roller and bands from  $\frac{1}{8}$  in. to  $\frac{1}{4}$  in. can be applied in this way at rates of 6 per minute for 6-in. diameter goods and 4 per minute for 10-in. pieces.

Finally stamping is a cheap method of applying simple decorations. Carved rubber stamps are charged with colour from a pad and applied to the ware by hand or machine. Flatware offers little difficulty; the pattern is built up on sponge rubber, impregnated with colour and applied to the ware as with hand stamping. The rubber can be contoured to suit the shape of the ware and a Neoprene belt used to ink the rubber evenly. This machine stamps at the rate of 12 pieces a minute and at present is used for stamping gold on glaze and with colour underglaze. Another method used designed rubber rollers which roll the edges of the article held in a vacuum chuck. It is limited at the moment for decorating potters biscuit underglaze and for gold on glaze, but development is in progress.

Mottling involves two or more colours being sprayed or applied to the ware with sponges and marbling allows coloured slips to flow together on the ware. Both these processes are well known to enamellers and need no further comment.

The enamellers' range is more restricted than the potters, but it is hoped this paper will be of interest in suggesting some techniques that may be of use to the enameller.

### DISCUSSION

MR. POVEY, referring to two-colour printing on the Murray machine, asked if it was necessary to fire between the application of the two colours, or whether the drying was done quickly. He also asked how the second colour was registered.

DR. GERMAN said that printing in two colours was not done to any great extent so far as he knew; normally the ceramic manufacturers printed in one colour and touched in afterwards by hand. Also, so far as he was aware, two colours could not be applied without drying; however, he did not see why another impression should not be put on.

As to registering, the machine had to be set up by experimenting on where the pad came down,

fixing it, and then the centring device would centre the products as they came on.

MR. R. M. WATERS asked what colours could be used.

DR. GERMAN replied that there was quite a number that could be used on pottery and he could not see why they should not be used by the enamelling industry. For example, he mentioned bismuth compounds, which might give a white or bluish lustre. Copper compounds would give a reddish-copper effect. Silvery compounds would give a yellowing effect, or they could be mixed to give special lustre effects. It was possible on pottery to produce those effects; in the enamelling industry the lustre that was produced would depend on the enamel underneath.

The best were dark red, dark blue, green or possibly black glazes. But it would be advantageous to investigate solutions of compounds of metals and he thought that some enamellers had done so.

MR. J. NICHOLLS, (Vice-Chairman of Council) said that in the enamelling industry a large amount of experimental work was done on various compounds, but they were not all satisfactory. He thought that, commercially, ferric chloride and stannous oxide could be used, but others were not commercial propositions so far as vitreous enamelling was concerned.

MR. S. E. A. RYDER, (Member of Council) remarked that, whereas the pottery industry were thinking in terms of millions, the enamelling industry were thinking in terms of, perhaps, hundreds. He asked if Dr. German thought the machines he had referred to in the paper would be a proposition for decorating enamelled ware.

DR. GERMAN felt that the machine could be used for decorating enamelled ware in the form of plates, etc. provided that the firm producing the ware had a large enough order in hand. It was not difficult to run on the Murray machine different types of decoration, if the copper plates were available. The cost of making a copper plate might be £20 or £30, and after that it was merely a matter of fixing it on the machine.

### Applying Colour Before Firing

MR. SEMPLE asked whether experiments had been made on applying colour to the basic surfaces before firing.

DR. GERMAN said the colour was applied to the bisque surfaces, which had already been fired. Experiments had been made on the application of colours to the clay, but so far they were not completely successful; and, so far as he was aware, nobody was yet applying colours direct to the dry clay ware. There were various difficulties in the way. But colour was certainly applied to the fired bisque and also to the fired

glazed ware. For enamellers, using opaque enamel, the problem was only to apply the colour to the cover-coat enamel; whether it could be applied to unfired enamel he did not know, and he felt that a lot of experimentation would be required in order to do it.

MR. NICHOLLS said that by the silk screen process it was possible to apply small designs, such as a trade mark or a name, to the bisque before it was fired, but the method was not successful for a big pattern. He had known it to be done only with one colour, a black or a red.

DR. GERMAN, in a further reply to Mr. Semple, said there was no proper answer. One of the troubles was that of the colour flowing around the edges. He was interested in Mr. Nicholl's remarks, that it could be done in a small way as, for example, for badging. It would be extremely difficult to apply designs and at the same time to prevent the colours running badly if an attempt was made to eliminate some of the firing.

MR. NICHOLLS added that the whole trouble when colour was applied to the bisque was that it tended to run when fired.

THE CHAIRMAN, (Mr. S. E. A. Ryder) said that even when it was done on a small scale the result was still not so good as when the colour was applied to a fired surface.

#### Coated Film Method

MR. MURDOCH asked if Dr. German would expand his remarks on the use of the coated film.

DR. GERMAN replied that he had no practical experience of it. Broadly speaking, however, the idea was that in the normal way a silk screen was prepared by taking the silk or copper wire mesh screen and blocking out, with some medium, the parts on which the colour was not required. There was available a type of film which could be set up in a camera, coated with, he believed, potassium bichromate; this was set up behind a photographic negative of the particular colour required. The potassium bichromate coating of the film sometimes had gum on it. When the film was behind the negative, the portions of it which received the light would harden and it could be developed by putting it in warm water; the parts which did not receive the light were dissolved away in the water.

PROFESSOR A. I. ANDREWS said that gelatin-coated paper, which could be ironed, could be used to make a stencil. Also, there was a method in which another kind of paper was used; the pattern was pressed down on the surface to which it had to be transferred, and the paper was peeled off. These methods were in addition to the silk screen and photographic methods.

MR. CHARLES said that modern types of film were just pressed to the surface of stainless steel

and allowed to dry; when the backing paper was peeled off, the screen was ready for use.

Abstract No. 8

## A CRITICAL ASSESSMENT OF VITREOUS ENAMEL IN THE HOME

by Miss J. E. Walley\*

### A Critical Assessment of Vitreous Enamel in the Home.

THE authoress recently visited a big London store to examine some examples of domestic vitreous enamelling only to find that very often she was looking at plastic or anodized-aluminium goods. It would appear that the vitreous enameller has not only to contend with competition in a field where he was once supreme but also that the housewife has a greater variety of choice and needs guidance in making her selection. One salesman said there was an increasing demand for better-quality goods, which means the purchaser is becoming more critical, a welcome thought for many reputed British manufacturers.

Some of the disadvantages of enamel are inherent in the material itself, while others can be eliminated by changes in manufacturing technique. The manufacturer should realize that his expectation of future sales rests more on a reputation of lasting quality than anything else, and it is far more important to satisfy this fundamental requirement than be a source of increasing dissatisfaction.

### Desirable Qualities and Characteristics of Enamelled Goods

**Durability.** Few can be expected to look new for long periods of time, and experience has shown that the majority of domestic goods should remain in reasonable condition even after very thorough treatment. The manufacturer must therefore choose between the following alternatives:—

- i) make the goods to resist the worst maltreatment;
- ii) make the goods to be reasonably resistant to casual treatment but presume some education and sense in the user.

**Ease of cleaning.** Modern standards of hygiene demand that domestic equipment should be easy to keep clean in which case they must have smooth shiny non-absorbent, non-tarnishing, non-corroding surfaces which do not stain. New vitreous-enamel goods fulfil all these requirements, but unfortunately they deteriorate after a period of use.

\*Head of Household Science Dept., Queen Elizabeth College, University of London.

**Colour.** Aesthetic considerations in kitchen and bathroom design have been known to weigh heavily against efficiency and durability. It is therefore important to maintain a balance between appearance and performance, and definite information made available on the wearing qualities of various colours.

**Cooking Performance.** This aspect is relevant only to a small number of utensils and will be discussed in more detail later. The physical qualities of the materials used, namely, enamel on steel or cast iron or aluminium, seriously affect the cooking properties, the most important of which seem to be the thermal capacity and conductivity. The general effect of heat absorption, particularly in relation to radiant heat, also enters into the problem and adequate consideration should be given to the colour and finish of these articles where performance is of prime importance.

**Weight.** The high specific gravity of iron and steel is an important factor when comparing enamel and aluminium utensils. Many utensils are too heavy to be handled with comfort by the housewife. The enamelled aluminium pans that have appeared recently are of course much lighter, although the value of the enamel is almost entirely aesthetic.

**Hygiene.** As mentioned previously, this is very closely related to ease of cleaning and a smooth regular surface, free from small pits and crevices, offers the best solution to the problem. Vitreous enamel when new has such a surface but deterioration of the surface offers an inviting breeding ground for germs and bacteria.

Another problem presents itself when the surface is chipped and particles of varying size flake off and appear in the food, constituting a possible health hazard as well as an unsavoury experience.

#### **Assessment of Products in Relation to the Above Qualities and Characteristics**

##### **Baths.**

Ceramic materials or the more recent resin-bonded glass fibre present no real challenge to vitreous enamel, but it is sometimes found that in spite of this or perhaps because of it, the surface condition of the baths deteriorate quite quickly and become porous, absorbing colours from the metals of the hot-water pipes or from the dyes of clothes. This loss of surface is caused by the indiscriminate use of abrasive powders and detergents by the housewife, and some attempt should be made to educate her in the use of more suitable cleaning materials. It is a fact that some coloured baths are more resistant than almost all white ones, but this is not generally known among householders, although many hospitals choose these on account of their resistance to certain additives used for the

treatment of patients. It is felt, therefore that greater consideration should be given to the testing of baths since durability and ease of cleaning are of paramount importance.

##### **Sinks and Draining Boards.**

The acid-resisting qualities of the enamel used on these items make them superior to many baths, and there are only two criticisms, namely, noise in use and proneness to chipping. The first is a function of the material properties, but probably something could be done about the second by improving the quality of the sink unit itself. Is it possible that an enamelled cast-iron sink is less likely to chip than one made from pressed steel?

##### **Working Surfaces.**

Tables, kitchen cabinets, refrigerators and washing machines may all have working surfaces of vitreous enamel and providing they are rigid and acid resistant are very acceptable in the kitchen.

##### **Saucepans, Casseroles and Frying Pans.**

The wide range of colours available and its ease of cleaning gives vitreous enamel the advantage over the many different materials and finishes available but porosity and loss of bloom again occurs after very little use, some pans being affected more than others. Can it again be a question of colour? The cooking performance of enamelled-iron pans compares favourably with other materials. There are of course some metals that are superior to enamelled iron for certain cooking processes, an example of which is the scorching of milk, but for boiling or simmering in water they are highly satisfactory and in some cases far superior to some other metals.

The housewife values a pan which can be used equally on the gas burner or hot plate, in the oven, on the table as a serving dish, and is virtually unbreakable, and the enamelled casserole fulfils all these requirements. Recently those made in the United Kingdom have surpassed the foreign made articles in both quality and appearance and one very new casserole with a casting made by the shell moulding process is so fine that it feels more like a good fire-proof ceramic than an enamelled casting.

##### **Cookers.**

Good wearing qualities and an attractive-efficiency are the main qualities required by the housewife for her cooker. Enamelled surfaces have much to offer in all these respects and the introduction of light colours has contributed a great deal to the appearance of new designs; but again the comparative wearing qualities of light and dark colours arises and some definite advice should be given by manufacturers regarding this.



Pressed steel is used almost exclusively today for the manufacture of cookers although it seems the cleaning of the enamelled sheet-steel surfaces is more difficult than the pre-war cast-iron models though they are freer from pin holes. Is this again a function of colour or does it involve quality of enamel, firing temperatures, quality and gauge of the sheet metal.

### Conclusions

The aim of this paper has been to try to assess the value of vitreous enamel for domestic equipment. In many cases it is unrivalled but it is felt that appreciation of its qualities would be increased if the user had a better understanding of the choice available, and the care required to maintain it. The manufacturer could help in two ways, first by producing goods as resistant as possible to careless treatment and second by making available more information. Few stores stock complete ranges of goods from which to choose, even in London, and the manufacturer, the retailer and the consumer would benefit if a better understanding were established of the relative requirements and limitations.

### DISCUSSION

THE CHAIRMAN complimented Miss Walley on her paper, which was, he said, a valuable contribution to the conference; it raised many questions which needed to be answered.

MR. W. S. GRAINGER (President-Elect) did not agree that a coloured enamelled bath was better than a white one. At the moment he was extremely concerned with baths, and if Miss Walley could persuade the bodies concerned with their production to agree to a standard for baths, particularly in respect of the resistance of the enamel to alkalis, she would be doing another great service to the users. One difficulty was that some ladies were quite reckless in pouring bath salts into a bath before turning on the tap, so that for a short while there was concentrated alkali in the bottom of the bath. Again, he mentioned a hotel having 900 rooms and 900 baths. Before long all those baths had matt surfaces up to a height of about 10 in. from the bottom, and they were taken out and replaced. That was happening now all over England, he added, and the representatives of the manufacturers were adamant in not accepting a reasonable British Standards Institution specification for alkali resistance.

Recalling a reference by Miss Walley to pressed-steel baths, he said the steel enamelling industry, with which he had been very closely associated, used to make alkali-resisting products; the casting enamellers did not.

MR. DURHAM (Vitreous Enamel Development Council) said Miss Walley has made a very important point for the industry, that the technical side of it, represented by the Institute, should work closely with the promotional side, the Development Council.

In the conference exhibition, he continued, Miss Walley would have seen quite a wide range of enamelled holloware which perhaps she had not seen before. That display was placed in all the London department stores, and overnight there was a 30 per cent. increase in the amount sold by the departments.

The Development Council still had a very large educational programme, and it involved the expenditure of a considerable amount of time, money and effort.

Concerning markets, he said that at one time a cheap range of holloware had been made and this had damaged the reputation of British enamelled holloware. Better-quality articles, in fact, better than anything offered anywhere in Europe, were now being made. But the British manufacturers had not yet realized that they had an international market for their products.

MISS HOUGHTON (Gas Council), who spoke as an ordinary user of enamelled ware and not in her professional capacity, felt, and believed many other people did, when thinking about British enamelled ware, that it was something really cheap and nasty. They had seen the new products from Scandinavia and from Holland and liked it, and were astounded when they saw something like it and found that it was British. The Industry had lot of prejudice to overcome.

She had suffered from vitreous-enamelled ware at home. But she had just moved into a home which had a new bath and sink, both vitreous enamelled. She resented having a new sink and having to buy polythene bowls, and so on, in order to avoid chipping the sink enamel, and she believed a lot of people felt that way.

Next, Miss Houghton urged that if enamelled products had limitations the industry should tell the public, who would welcome the fact that they were told and would understand better, and the industry would not have to face anything like the prejudice which had built up because the limitations were not properly understood. The users of certain washing machines were given instructions not to use them in certain circumstances. She hoped the enamelling industry's information service would tell the public what they could not do with enamelled ware.

PROFESSOR A. I. ANDREWS recalled that at a time when he and his colleagues were doing research work for the enamelled ware manufacturers they had obtained quite a number of standard pots from the manufacturers and had sent them out



to 20 householders at a time; that was done repeatedly over a period of four years, and some difference was found in the manufacturers' products. Some people treated the pots badly and they provided useful information, whereas those who treated the pots carefully did not.

MISS WALLEY noted the fact that some people treated the products well and others treated them badly. The only answer to that was that manufacturers must make their products with that in mind.

### Specifications to Meet Requirements of the Housewife

MR. W. S. GRAINGER, commenting that husbands nowadays knew almost as much about house-keeping as did their wives, urged that it was up to them to devise specifications to meet their wives' requirements. He was concerned particularly with sinks and baths and other household products, and if they were satisfied that baths were made to a scientific specification devised by scientific men they would not put bath salts into baths before turning on the taps.

MR. H. WHITTAKER pointed out that the enamel used on aluminium was of an entirely different kind from that used on steel. He did not think that enamel applied to the insides of aluminium pots and pans would withstand the heat without suffering damage. So that he thought users would have to be satisfied with the aluminium pots enamelled only on the outside.

He added that aluminium could be cleaned as well as anything else.

MISS WALLEY did not agree that aluminium was all that easy to clean, and still maintained that an aluminium saucepan with an enamel lining would be much easier to clean than the aluminium. She would very much like to have an aluminium saucepan enamelled inside and outside, in order to see whether the enamel would withstand ordinary use.

A SPEAKER issued the warning that to use plastic bowls in enamelled sinks was the worst possible thing to do, because the bottom of a plastic bowl would pick up grit, which would ruin the enamel at the bottom of the sink.

A SPEAKER said it had come to his notice that some of the concoctions which the ladies put into their baths had become stronger during the last four or five years, i.e. they were rather more caustic than formerly. That could be a reason why the enamel in baths nowadays did not remain quite so good as it did previously.

### Coloured Finishes and Radiant Heat

MR. DUNNING referred to the mistaken idea that coloured finishes were differently affected by

radiant heat as compared with black or white finishes. For saucepans, hot plates or hot-water radiators the finishes were equally efficient, whether they were black, white or any colour; the difference in colour had no effect. Many people were not clear in their minds concerning the difference between solar radiation and low temperature radiation. If the two were not different it would be found that people who wore white suits in tropical situations would die from heat stroke, because the heat could not get away. If a man clothed himself in aluminium he would fall dead from heat stroke.

Next, Mr. Dunning said he had heard that one woman who had a new bath installed experienced trouble with it. Finding that it was guaranteed, she wrote to the manufacturers, who asked her to remove the bath and send it to them carriage paid, and if it were faulty they would replace it. He commented that thereby they were pointing a pistol at the housewife, who really could not do anything about it.

In regard to cookers, Miss Walley had stated in her paper that the quality of the enamelled surfaces was high. This showed, said Mr. Dunning, that if we could have quality standards such as were aimed for, and achieved, in the case of gas cookers, they paid dividends by way of the results obtained.

A SPEAKER mentioned an area in which there were 50 flats, fitted with baths having exactly the same enamel, but two of those baths had gone wrong. He did not think the enamel was at fault, but he made the point that the public really ought to be educated a little more concerning the way in which baths should be treated. There were some people who did not clean baths each time they were used. One of the best ways of keeping a bath clean was to dry it each time it was used.

### Should All the Blame be Put on the User?

MR. SEMPLE, who was rather opposed to the policy of blaming the user, said that a steel bath could be enamelled with a higher degree of alkali in the enamel.

Concerning wear and tear, the frit makers prided themselves on having improved their products greatly. He felt that with the very much lower initial quality of finish people did not notice the wear and tear in pre-war days.

Next, he posed the question as to whether it would not be better if certain domestic utensils were not finished in vitreous enamel. The enamelling industry could do so much, and beyond that they might say that particular items would be better in aluminium or tinned steel. His view was that the large rigid surface should be finished in vitreous enamel. He mentioned the most modern finishes on the outsides of washing machines

(Continued in page 150)

Oil and Colour Chemists' Association

## The O. C. C. A. Exhibition

THE 11th Technical Exhibition of the Oil and Colour Chemists' Association, formed in 1918 to further the scientific development of raw materials and equipment for the paint, varnish and printing ink industries, was held at the Royal Horticultural Society's New Hall in London last month.

On the following pages appear some details of the material displayed by the firms taking part.

### **Allied Colloids (Bradford) Ltd.**

*Cleckheaton Road, Low Moor, Bradford.*

The Allied Colloids stand had on show, among their range of polyester lacquers and pigments, two metal primers of particular interest to the metal finishing industry.

Hardness and high chemical resistance characterize the many stoving finishes and they are mainly used for corrosion protection where appearance is of secondary importance, but a modified urea resin, marketed under the name of Plastopal in many grades, yields pale or white finishes whose shades are not affected by light or temperatures up to 180°C. and can be used for decorative purposes such as metal furniture, bicycles and cars. Many types of finish can be obtained by combining the appropriate grade of the resin with either stoving alkyds or pigments. For weather-resistant stoving finishes the brittle grades can be employed in combination with a non-yellowing alkyd, the proportions varying according to the intended application and to the number of coats to be applied, whether spraying or brushing. For pigmented finishes additions of rutile titanium oxide can be added, toned with an inert, heat- and solvent-resistant inorganic pigment such as cadmium red or heliogen blue.

EMU powder 120 FD, is a styrene copolymer, and can be readily dispersed to stable emulsions



Fig. 1—General view of stand of Allied Colloids (Bradford) Ltd.

in dilute ammonia and other dilute alkalis. When combined with suitable plasticizers, the emulsions dry to clear films which are tack-free or slightly tacky and can be employed for surface coatings. The films show very good light-fastness and resistance to ageing, and one notable contrast to other films of polymer emulsions, is that they swell only very slightly in the presence of water. They form, however, poor film and require the addition of plasticizers with solvent properties, namely the majority of phthalates and certain adipates. The proportion of plasticizer employed once again depends on the nature of the application and also on the solvent properties of the plasticizer and the drying temperature of the emulsion.

### **Associated Lead Manufacturers Ltd.**

*Clements House, 14 Gresham Street, London, E.C.2.*

Associated Lead Manufacturers have been engaged in the manufacture of lead pigments for over two centuries and many of the main types of pigments produced by them were on show.

White lead, originally made by the Stack process, is today produced by the direct action of purified carbon dioxide on lead oxide which allows a more exacting control over particle size, colour and general pigmentry properties. The chief grades are distinguished by their relative stain resistance. The low-stain white lead is characterized by its low oil absorption and is used for the manufacture of coloured oil-based paints. The general-purpose white lead is medium stain, and has a fairly low oil absorption used extensively for priming paints, undercoats, oil gloss paints and coloured hard-gloss paints. The high-stain variety, characterized by its fine particle size and high oil absorption, has excellent covering power and enables it to be used in hard-gloss finishing paints.

All of these types are easily dispersed in oil and react during the life of the paint to form lead soaps and glycerides, forming an elastic film having long term durability. The weathering of white lead paint takes the form of mild chalking and provides an excellent surface for subsequent repainting.

Red-lead paint is the traditional material for painting iron and steel and is at present manufactured to conform to B.S.S. No. 217 where three types are described by their particle size.

Type A has the lowest  $Pb_3O_4$  content, the remainder being a lead monoxide. It reacts rapidly with linseed oil to form tough, durable films in thick layers, and is chiefly used for jointing compounds and for paints mixed on the job. The second, type B, has a higher  $Pb_3O_4$  content and reacts more slowly with linseed oil. Some ready-mixed paints are made from this grade but must be used within a short time of manufacture. The final category, type C, contains the highest proportion of  $Pb_3O_4$ , and can be used to make ready-mixed paints with good storage properties, and in suitable media, quick-drying paints.

Also on show at the stand was Caldiox and Timinox. Caldiox is a compound of calcium oxide and lead peroxide. It is a rust-inhibitive pigment characterized by its light colour and low density and can be incorporated in resin-based media to produce paints for application by brushing, spraying or dipping. The light colour of the pigment enables a range of paint colours to be made and its adhesion to newly galvanized surfaces makes it particularly suitable for priming galvanizing.

Timonox, antimony oxide, is a brilliant white colour with a fine particle size and high covering power. As a paint pigment, it is chiefly used in enamel paints and as a special blending agent with other pigments to improve weathering characteristics. It is claimed to have special flame-resistant properties and is used as a pigment in plastics where its flame-retardant properties make it specially valuable in cable covering.

#### **Bakelite Ltd.**

12-18 Grosvenor Gardens, London, W.1.

During the last twelve months, work has been carried out on the development of solventless coatings and this work formed the basis of the company's stand at the exhibition.

Principal interest has centred around the use of solventless epoxide resin hardener systems where it is possible for the user, by the addition of a filler, to provide a coating up to 0.015 inches thick in one application. Films harden overnight under normal conditions, but hardening continues for several days after application. A range of pigments and colour may be used. Drainage of thick films on vertical surfaces has been minimized and flow-

out is claimed excellent. The coating system is normally applied by brush but other methods of application may be possible such as roller coating, curtain coating or doctor blade. Laboratory tests have indicated that this system is likely to be suitable for the protection of many substrates, particularly metal and concrete, and it may also find a use as a trowelled-on resistant floor coating.

#### **Baldwin Industrial Controls**

Dartford, Kent.

Photometric instruments for the measurement or comparison of colour were featured on this stand with working models being demonstrated. These instruments can be broadly classified into two groups according as to whether (1) they measure colour by determining spectral reflectivity characteristics, or (2) by matching it with a mixture of three specified colours. Instruments of the second kind suffer from the drawback that measurements are carried out, as a rule, by a rather slow process of visual matching. Instruments of the first group are thus preferable in many applications where it is desired to control colour constancy and compare two colours rather than express their composition in terms of three stimuli. They give objective indications easily correlated with colour differences.

It is possible to obtain the complete spectral reflectivity characteristics of a specimen but it requires a great deal of work and expensive apparatus. Fortunately simplified methods of photoelectric comparison of reflectivities based upon the use of suitable light filters in conjunction with an attachment made by Baldwins, afford a simple and rapid method which is perfectly adequate in accuracy for practical colour work, as for instance in colour printing. The use of filters does not introduce serious errors since the spectral reflectivity curves of pigments do not, in general, show very sudden variations at different wave-lengths, but tend to be characterized by broad partial absorption bands.

In using filter methods one has the choice either of sampling the reflectivity curve at a number of points using a set of narrow cut spectrum filters, or of determining average reflectivity in each of three broad spectral regions selected by means of the usual separation filters. Which of these two methods is to be used in a particular application depends upon the accuracy desired and is best decided by trial.

The equipment on show on the stand included the following:—

**Reflection Densitometer:** A direct-reading instrument for the measurement of colour, consisting of a highly stable d.c. amplifier and specially selected vacuum photocell. The indicating meter is a 'dead-beat' moving-coil meter and can be

supplied with a linear calibration of 0-100 or with near linear density of 0-4.

**Quantex Light Quantity Meter** : An integrating unit which measures the total illumination received by a vacuum-type photocell. The instrument can be fitted with a self-operating device, enabling it to measure light quantities over long periods, and the unit will automatically compensate for fluctuations in mains supply or the flickering of arcs or other light sources. It can be used with any type of fadeometer and filters can be fitted to isolate that wavelength responsible for fading.

**Comparator Densitometer** : Designed for the measurement of turbidity and colours of paints, liquids and varnishes, in a continuous process by comparison with a standard. As a null balance indicator, this instrument can detect differences of about one part in one million and the filters are fitted to enable the user to measure colours.

**Baldwin Colormat** : This instrument compares quantitatively the reflectivity of surfaces against reflectivity of standard specimens over the whole or part of the visible or near ultra-violet spectrum. Using magnesium oxide or carbonate as 100 per cent reflectivity, it performs this comparison to an accuracy within 0.1 per cent. Being designed for the easy comparison of colours of a similar composition, the instrument enables the complete visible spectrum to be covered in small bands as well as the relatively high bands of the tricolour series, the makers claim, and the light source is such that examination of the fluorescence of samples can be made. The instrument caters for flat samples of varying area and thickness and a special dish is provided for powders.



#### **Beck, Koller and Co. (England) Ltd.**

*Beckacite House, Speke, Liverpool*

The chief exhibit on the company's stand this year was 'Beckosol 3020' a short-oil alkyd based on castor oil and trimethylol propane (T.M.P.)

As a component of short-oil alkyds, in comparison with glycerol, T.M.P. is claimed to give greatly improved alkali-resistance and higher gloss in stoving finishes with urea and melamine resins. These advantages have been incorporated in an alkyd modified with a saturated oil, the colour-retention under heat thus being of a high order. It has also been found that the gloss-retention under heat is better than that of comparable alkyds based on glycerol, the company says.

Another application of this alkyd is the epoxy-resin finishes of the three component type (epoxy-resin/alkyd/melamine resin). It gives finishes of high gloss at pigmentations sufficient to ensure good capacity, good colour retention at high stoving temperatures and much better alkali resistance than a system containing a glycerol alkyd, it is claimed, and these advantages are obtained without any sacrifice of other desirable properties such as hardness and flexibility. It is particularly suitable for domestic appliances and motor car repairs, and examples of work being done with it were shown.

#### **F. W. Berk and Co. Ltd.**

*Berk House, P.O. Box 500, Portman Square, London, W.1.*

The stand this year emphasized recent developments in paint decoration with particular reference to multi-colour finishes applied by spraying techniques. Two or more organic pigmented coatings are usually dispersed in an aqueous carrier, in such a way that the finished effect on drying is a paint film with a random pattern of colours.

Currently, much attention has been centred on the dispersion of modified styrene-butadiene enamels in a water base. In order to obtain the proper spatter effect, each of the individual paint colours must be maintained as discrete paint particles and not allowed to blend together in the aqueous base. The individual particles must also retain their shape after spraying and during the drying period.

The company claim that two of their products have not only helped to make the desired particle control possible, but have also improved the working properties, performance and package stability of these multi-colours paint systems.

Fig. 1—Ben-a Gel and Bentone 38 were displayed by F. W. Berk, part of whose stand is shown on the left



Bentone 38 acts in the pigment bearing organic paint portions of the multicolour paint. It controls viscosity, suspends particles and restricts flow in the internal phase of the paint systems. By producing a controlled increase in thixotropic viscosity, it also enables the formulator to select the shape and size of particle desired in the final mix, whether it be round or elongated, small or large. Since the viscosity is also claimed to be reproducible, stable and unaffected by temperature change, the particle size and shape is also reproducible and stable. When the paint film is applied, it controls penetration of the organic paint portions into porous surfaces insuring colour uniformity. Additional claims for this gelling agent are its complete insolubility in both the organic phases and the water base and also the fact that it does not retard the natural rate of solvent evaporation.

The other product shown in conjunction with the multi-colour finishes was Ben-a Gel, a highly purified magnesium montmorillonite which is a new thickening agent for water systems. It produces a thixotropic gel in the aqueous phase of the multi-colour paint, with beneficial properties that are similar to those contributed by Bentone 38, to the organic liquid phases. The manufacturers claim that it effectively controls the viscosity and flow of the water carrier base, and by acting as a protective colloid, it helps maintain the separation of the varied organic portions so that the different colours are prevented from flowing together and destroying the multi-colour effect. Like Bentone 38, it is insoluble in both the water and the organic phases, and does not interfere with the rapid release of water or organic solvent. A special note from the company has been made that both these products provide excellent mechanical paint stability when the multi-colour is subjected to intensive shaker testing.

■ **British Titan Products Co. Ltd.**  
10 Stratton Street, London.

The main feature of the Company's stand this year was to make available information regarding the service and facilities provided at the Carlton Weathering Station, recently built on a ten-acre site, five miles west of Stockton-on-Tees in County Durham. The site has been specially selected for its extensive flat aspect, exposed to the prevailing winds, where the absence of landscape features and freedom from industrial pollution make it possible to carry out both rigorous and authentic weathering tests. It has been carefully planned to include every facility for exposure of specimens under all normal conditions, for the laboratory examination of results and for the scientific assessment of a wide variety of research projects. A closer look at the facilities provided go a long way



Fig. 2.—British Titan Products featured the design of the Carlton weathering station.

to substantiate the claims that this is probably the most modern station of its kind in Europe.

The layout of the station comprises a block of laboratory buildings and test fences for exposure of specimens and also a glass house and a meteorological section. At present there are twelve 45-deg. racks, each 100 ft. long and carrying either four or seven rows of steel or wooden panels. The total capacity of these racks is approximately 14,000 standard test panels. Four vertical racks 100 ft. long are designed to carry approximately 4,000 concrete slab specimens and two 100-ft. long vertical clapboard racks accommodate a further 3,500 standard test panels. One section of racks incorporates a sprinkler system which enables a pre-determined volume of water to be sprayed on particular specimens for fixed periods, as called for in certain tests.

The laboratory buildings comprise a large reception room, a modern laboratory equipped with all the latest testing and recording instruments necessary to the station's work. A fully-tiled air-conditioned room for the preparation of specimens before exposure is also provided.

Measurements are made with the normal meteorological instruments supplemented by special devices to record extra data of particular value in the assessment of exposure test results. The essential information is collated as monthly reports and annual summaries, both of which are made available to those interested in the tests being carried out.

The glass house, for testing materials not normally exposed directly to the weather, completes the facilities provided at the station. The inside temperature of the house is maintained above the dewpoint and both temperature and humidity are continuously recorded.

The company emphasized that they are willing to arrange test programmes for manufacturers interested in submitting their products to this type



of testing, and extend an invitation to them to visit the station in order that they may see how the facilities provided could influence future developments.

**B.I.P. Chemicals Ltd.**  
*Oldbury, Birmingham*

Recent developments in amino and alkyd resins for industrial stoving enamels were featured on this stand, and included a urea/epoxy co-condensate which can be used alone or in combination with oil modified alkyd resins.

Also featured was a semi-drying oil-modified trimethylol propane alkyd, which in combination with urea and melamine resins produces finishes claimed to have improved water, alkali and detergent resistance.

Improved acid catalyzed urea and melamine-based woodfinishes were also shown, together with exposure panels illustrating the exterior durability of these types of lacquers. Urea and melamine resins, etherified with iso-butyl alcohol, continue to prove of interest to the paint industry and many of the more recent improvements in these types were exhibited.

**Rex Cambell and Co. Ltd.**

*7 Idol Lane, Eastcheap, London, E.C.3*

The combined stand of Rex Cambell, Co. Ltd. and The Chemical Supply Co. Ltd., displayed a range of cadmium reds and yellows which are claimed economical in use yet retain all the expected characteristics of this class of pigment, such as heat and light resistance, brightness and chemical resistance. These qualities make them ideally suited for use in both paints and plastics.

Cuprous oxide, the principal toxic ingredient of all marine anti-fouling paints, has up to now had poor stability in the dry powder state, but on show on the stand was a grade now being offered, as a result of a new production plant using a modified

process, with much improved keeping qualities and dispersibility.

The water-soluble Aroclon resins, which were introduced last year, were again featured with a variety of new formulations giving excellent corrosion resistance in the case of primers and good gloss and adhesion for finishes. Information was also available on the Scadoform speciality phenolic resins for combination with Epicote to give paints and clear lacquers with high water and chemical resistance. Among the number of new alkyd resins was a pure drying oil modified resin, suitable for either air-drying or baking and having a touch-dry time of 5 to 10 minutes, and a solvent resistance claimed superior to styrenated alkyds.

Also on show were two paint additives, widely used in the U.S.A. where they are manufactured by Baker Castor Oil Co. A feature of these additives is that when they are incorporated by the correct milling techniques, they improve pigment suspension and brushability, control flooding, floating, penetration and sagging.

An interesting feature was made of the use of epoxy plasticizer R.C.1 and its use in a novel nitrocellulose lacquer system where it is crosslinked into the film by the addition of a catalyst, resulting in clear wood finishes and pigmented lacquers with improved adhesion, greater flexibility and high solvent resistance. Also of interest to the lacquer manufacturers' was di-iso-decyl phthalate plasticizer, now available for the first time. It is claimed to have very useful non-migratory and low volatility characteristics.

For the ink technologist, special information was readily available on a number of Arochem and Arplaz resins and Dryfol co-polymer oils, designed to meet his needs for use in all types of printing inks.

**CIBA (A.R.L.) Ltd.**  
*Duxford, Cambs.*

The display on the company's stand this year illustrated the properties and applications of the wide range of Araldite epoxy resins available for the surface-coating industry. Brief details of the range are given below.

**Araldite 820-RH:** This is a two-part formulation consisting of a resin and a hardener and has been specially developed to form the bases of cold curing finishes or, alternatively, of finishes that cure rapidly at elevated temperatures. These coatings may be clear or pigmented, and cure without blushing even at high relative humidity.

**Araldite 985 and 916a:** Both these products are for hot cured finishes, and are used in the



Fig 3.—Cadmium reds and yellows for paints and plastics were shown on the Rex Cambell stand

electrical, food processing, chemical engineering, textile and aircraft industries.

**Araldite 880-AB:** This product, supplied as two viscous solvent-free solutions, can be used in the preparation of clear or pigmented stoppers which cure in a short time with very little shrinkage. Thick films can be applied in one operation.

**Araldite 982-AB:** There is a tendency to reduce stoving times in continuously-operating ovens by working at higher temperatures, and under these conditions it is essential to employ a finish which is tolerant to a certain latitude in curing conditions. Lacquers based on this have a wide stoving range, (3 to 15 minutes at 240°C. or 40 to 80 minutes at 180°C.).

**Araldite 6000 series:** This is a series of basic epoxy resins introduced for paint manufacturers who may wish to formulate their own finishes.

#### Cray Valley Products Ltd.

St. Mary Cray, Orpington, Kent

The main features of this stand were the Resydrol water-soluble resins for industrial stoving finishes and Gelkyd thixotropic resins.

The new range of Resydrol resins have only recently been introduced to the British market, although they have been available previously on the continent. Exhibits were shown illustrating the industrial usage of these resin-based paints both as primers and finishes on a range of metal substrates. There was also displayed, panels showing the various types available, and illustrating both the film properties obtainable with this new class of resin, and the corrosion resistance which is claimed a particular feature of the phenolic types.

The Gelkyd exhibit this year was particularly concerned with the problem of one coat gloss finishes, and exhibits demonstrated that one coat cover gloss finishes can readily be achieved by controlled thixotropy in the paint, and at the same time showed some of the problems of one coat cover and some of the pitfalls in producing paints of this type. A new thixotropic alkyd was on display, intended as a potential universal thixotropic alkyd since by blending with conventional alkyd it can be used to produce gel paints in all degrees of gloss.

Surface coatings and adhesives produced using Versamid polyamide resins were also on show, among which were several new products and included the isophthalic alkyd, Synolac 20W, a vinyl toluene modified alkyd, Synolac 24W, and a poly-amino curing agent for epoxy resins, Synolide 960.

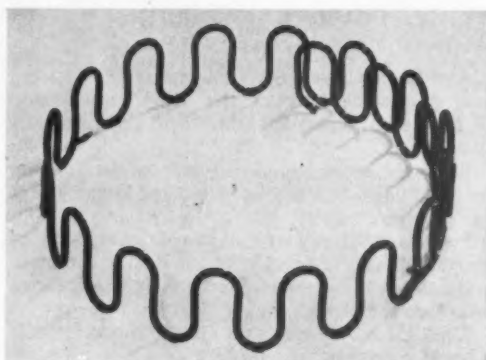


Fig. 4.—Bed springs coated with a Resydrol based finish, exhibited by Cray Valley Products.

#### Evans Electroselenium Ltd.

St. Andrews Works, Colchester Road, Halstead, Essex

The importance of measuring gloss in the paint and plastics industry has long been recognized and the manufacturers of the "Eel" high and low gloss heads, Evans Electroselenium Ltd., had on display on their stand a photoelectric instrument—an adjustable gloss head, capable of taking measurements of gloss at varying angles.

Designed to work in conjunction with the standard galvanometer unit, it provides a means of measuring the gloss of a sample at any desired angle over the range of 15 to 85 deg. It comprises a lamp unit and photo-cell unit, both of which are mounted with a separate pivoted lever. The lever arrangement is fitted to a stout base plate and has a light-tight cover. A recess at the front of the instrument accommodates a sample up to 6 in. in width, and a spring clip holds it firmly against the aperture.

In operation, the galvanometer is adjusted to a reading of one hundred divisions with the standard in position, after the photo-cell and lamp units have been set to the desired angles. The standard is replaced by the sample and the reading noted.

(continued in page 150)



Fig. 5.—Evans variable angle "Glosshead".

## O.C.C.A. Exhibition

(continued from page 149)

Also on display on this stand were the following instruments made under the "Eel" trademark, all having particular applications in the paint and allied trades:

Photo-extinction sedimentometer for determining the size characteristics of powdered materials in the sub-sieve range.

Powder reflectometer for the determination of specific surfaces of powders of less than one micron.

Gloss heads, developed for the rapid and accurate measurement of high gloss.

Mark III reflectometer for routine measurements of total brightness and opacity.

Reflectance spectrophotometer, approved by the Printing, Packaging, and Allied Trades Research Association for quick, accurate assessment of spectral characteristics of a colour and for off-white measurements.

Haze meter for measurements of haze and luminous transmissions of transparent plastics according to ASTM D. 1003-53.

(To be concluded).

## Phosphate Coatings

(Continued from page 136)

no rinse on free draining articles; one hot or cold rinse for general use; and an extra chromate rinse if desired. With accelerated processes, one running water rinse followed by a further running water or dilute chromate rinse is the general specification. Only one running-water rinse is necessary before a water soluble stain. Also, the chromate rinses can be used hot or cold. The specifications are generally similar regarding the composition and concentrations of the final "chromic" or "chromate" solutions but the British Standard allows a slightly higher accumulation of treatment chemicals in the rinse waters (1 ml.) as compared with DEF-29 (0.75 ml.).<sup>(1)</sup> The growing practice of using a final mist spray of de-mineralized water on automatic spray plants is presumably taken care of in the Specification by the clause "If necessary, precautions shall be taken to avoid local accumulation of solid residues such as may be formed on the surface from a hard water used in rinsing."

On the question of the treatment of creviced components, composite articles and high strength steels, the British Standard follows the prior teachings of the DEF Specification.

## Inspection and Testing

The inspection and testing requirements in both Specifications are broadly speaking very similar. Both refer to the tests of PD 539 for establishing the presence of a phosphate coating although with

different emphasis. Both approve the use of test panels or test specimens prepared under prescribed conditions in place of actual articles in acceptance tests where both use the same method for determining (a) phosphate coating weight, (b) freedom from corrosive residues and (c) resistance to corrosion. Coating weight is determined by stripping in inhibited hydrochloric acid but by agreement with the Inspection Authority, for approximate practical purposes DEF-29 specifies an alternative method based on determination of the phosphate content of the solution used to dissolve the coating from a known area of the component.

## A Critical Assessment of Vitreous Enamel in the Home

(Continued from page 143)

refrigerators and cupboards. Were they durable from the point of view of gloss or colour, and were they resistant?

MISS WALLEY did not agree entirely with Mr. Semple's remarks about the small utensils. Such a utensil might be knocked about and chipped; but if it were not, then apart from using it for heating milk, etc., it was very satisfactory and it had a surface which was easily cleaned.

Expressing agreement with his remarks concerning large surfaces such as the tops and sides of refrigerators, she said there were a number of them now which had working tops vitreous enamelled.

## Zinc Coatings on Iron and Steel

(Continued from page 133).

however, the weld can be made at about 900°C. so that very little of the zinc coating boils away if the operation is carried out rapidly and smoothly, using a minimum of heat. The filler rod used in this process contains 60 per cent. copper and 40 per cent. zinc with about 0.3 per cent. silicon.\* so the term "bronze welding" is, strictly speaking, a misnomer. In the hands of an expert operator, the process gives strong welds with good resistance to corrosion at the joint.

\*The composition is specified in B.S. 1724 : 1951.

## References

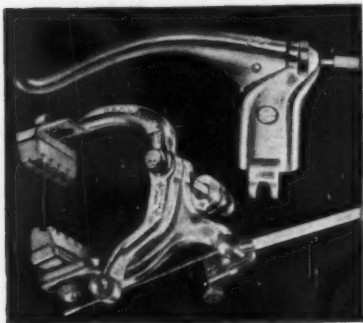
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## FINISHING

## NEWS REVIEW

FIRST INTERNATIONAL CONGRESS  
ON METALLIC CORROSION

THE First International Congress on Metallic Corrosion to be held under the auspices of the International Union of Pure and Applied Chemistry will take place in London on the 10th-15th April, 1961. A Scientific Committee has been set up, under the Chairmanship of Mr. L. Kenworthy (the present Chairman of the Corrosion Group of the Society of Chemical Industry), to organize scientific sessions of the Congress, and the Committee now invites papers on any aspect of metallic corrosion for presentation at the Congress meetings. It is intended to devote much of the Congress to discussion of papers dealing with original work, but first-class up-to-date review papers will also be welcome.

Preprints will be issued well before the Congress and authors of papers accepted will be invited to introduce their papers briefly for discussion at the meetings. All papers, together with discussions, will subsequently be published in book form as the Proceedings of the 1st International Congress on Metallic Corrosion: London, 1961, and papers accepted for presentation at the Congress must not be published elsewhere without permission of the publishers.

Those wishing to submit papers, which should preferably be in English, should send the title and a synopsis before April 30, 1960. The complete manuscript in duplicate of all accepted papers must reach the organizers not later than August 31, 1960. The Scientific Committee reserves the right to limit the number of papers presented in order to ensure adequate time for discussion.

Papers, synopses and correspondence regarding papers should be sent to the Hon. Secretary of the Scientific Committee, Mr. H. S. Campbell, The British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1. All other enquiries should be addressed to The Hon. Secretary, 1st International Congress on Metallic Corrosion: London, 1961, 14 Belgrave Square, London, S.W.1.

PAINT FIRM  
OPEN TWENTY-  
SIXTH PLANT

INTERNATIONAL Paints (Canada) Ltd., have announced that their 26th manufacturing plant will commence production in May, 1960. The new factory, which is at Regina, Saskatchewan, will produce a full range of industrial and household paints.

## REINFORCED PLASTICS FOR DEGREASING PLANT

THE acid degreasing unit comprising 10 ft. and 20 ft. long heated acid tanks, rim fume extraction, fans ducting, pipework, wash tanks, soap and creosol tanks shown below, has been designed, manufactured and installed by Turner and Brown Ltd., Bolton, to the instruction of The Ministry of Works for use at a Government Research Base. It is of particular interest since a majority of the equipment including the acid tanks are manufactured from Cobex Rigid P.V.C. reinforced with glass fibre. The acid tanks contain concentrated nitric acid, at ambient temperature, a mixture of nitric and hydrofluoric acid heated with "Carbinert" immersion heaters, and concentrated hydrochloric acid.

The design of the rim fume extraction system allows maximum accessibility to the tanks, since the ducting forms an integral part of the tanks; mechanical or accidental damage is reduced to a minimum as exposed ducting is also manufactured from rigid P.V.C. reinforced with glass fibre. This equipment is primarily used for the degreasing of fabricated stainless-steel pipes and fittings.



## Revolution Foreseen in Marine Surface Coatings

**I**N reading a paper entitled "Surface Coatings for Marine Conditions" before the Society of Naval Architects and Marine Engineers in Montreal, Mr. R. A. Hartley of the International Paints Organization, referred to the possibility of a complete change in the near future in the types of paints to be used for marine coatings.

The paper, which can be examined at the headquarters of International Paints, Ltd., Grosvenor Gardens, London, S.W.1., contains 44 pages of useful information dealing with galvanic and electrolytic forms of convertible coatings; fouling organisms and methods of combatting them; the report is supplemented with illustrations and graphs.

A concluding chapter refers to the use of water-soluble and water-dispersible paints (in the automobile industry) and the work done in the field of thick coatings. The technique of formulating and the application of multimil, mastics and 100 per cent. solids surface coatings is considered to be worked out and in the very near future foolproof 100 per cent. coatings will be available based on epoxide and isocyanate resins. The newer application techniques involved include a spray unit for two component paints which meters in the materials at a pre-determined ratio and only allows them to mix just before emission from the spray gun. Using this technique 100 per cent. solid coatings may be applied up to 30 mil. thick.

The author considers that the tendency of surface coatings is towards the production of tailor-made coatings and a start has been made to produce resins with pre-determined characteristics, which when completed will bring about a major revolution in the paint industry in that it will then be possible to predict accurately the performance of any paint system and enable the paint chemist to choose the most suitable coatings scientifically. It is probably assumed by the author that equal advances will be made in the method of marine paint application before these special coatings can be used generally.

The paper also refers to the research being conducted in the antifouling field into the metabolism of fouling organisms and efforts being made to produce an antimetabolite.

## LECTURES ON THE THEORY AND PRACTICE OF BRIGHT METAL FINISHES

**A**COURSE of six lectures was held at the Borough Polytechnic, Borough Road, S.E.1., on Tuesday evenings during the period March 1 to April 5. The lectures which were given by specialists commenced with an introductory lecture by S. W. Baier, A.R.I.C., of the British Non-Ferrous Metals Research Association dealing with the general classes of brightener, "foreign metal" ions, organic brighteners and the general theories of organic brighteners. This lecture was

followed successively by lectures on "Bright Tin and Tin-Alloy Finishes" by R. M. Angles, A.I.M. (Tin Research Institute). "Bright Copper, Cadmium and Zinc Plating," by H. Cann, (W. Canning and Co. Ltd.), "Bright Nickel and Chromium Plating," by H. C. Castell, (Mond Nickel Co. Ltd.), "Bright Anodizing" by F. C. Porter, M.A. (Cantab.), A.I.M. (Aluminium Development Association) and "Electro-Polishing and Brightening," by V. F. Henley, B.Sc., F.R.I.C., F.I.M., (W. Canning and Co. Ltd.)

### STELVETITE DUCTING IN NEW BERYLLIUM PLANT

**S**TELVETITE, plastic-coated sheet steel, forms the interior of the P.V.C./Steel/reinforced epoxy resin laminate used for a ventilating shaft fabricated by Ductwork Ltd. and resin coated by Parglas Ltd. and installed inside an existing reinforced-concrete stack 270 ft. tall at the works of the National Smelting Company Ltd., Avonmouth.

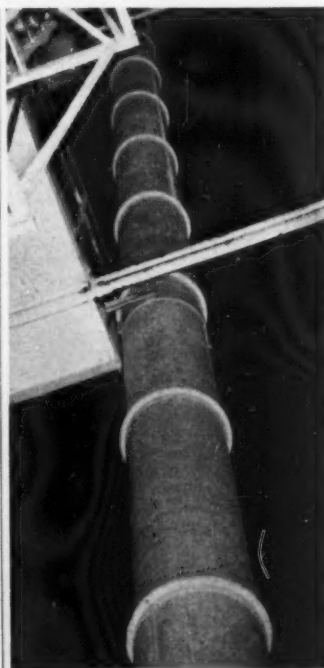
Stelvetite was suggested by Parglas Ltd. as the most economical means of providing the basis of a rigid structure which, with its internal lining of P.V.C., would be resistant to the traces of acidity present in the filtered ventilation gases: the external applied coating of epoxy resin is resistant to the traces of ammonia in the surrounding atmosphere.

The structure forms part of the new beryllium plant which has been in production since November. This is the only commercial operating plant extracting beryllium in the United Kingdom. It provides this metal for sheathing uranium elements in atomic energy furnaces and other purposes.

## Cleveland Tools Ltd. Extend Range of Surform Hand Tools.

**T**HE Surform Division of Firth Cleveland Tools Ltd., a member of the Firth Cleveland Group, has appointed Mr. N. Withers as Surform industrial representative. Mr. Withers, who has a practical engineering and production background, is to investigate and recommend new applications for the Surform and Surcut range of hand tools and power tool attachments.

Practical experience of the value of Surform in industry has increased side-by-side with the growth of the Surform range of tools—from two tools in 1957 to twelve in 1959, with more promised for 1960. The body of knowledge now available comes from craftsmen of all kinds and the wide range of materials on which Surform tools can be used extends to all metals up to a hardness of mild steel, and includes those which, because of clogging or flaking, raise particular shaping problems.



## NEW RANGE OF LIGHT VANS NOW IN PRODUCTION

### Special Attention to Corrosion Protection and Finishing

THE first British range of 15-cwt. forward control vans and passenger vehicles with independent front suspension are now in full scale production at the new Dunstable assembly plant of Commer Cars which is considered to be one of the most modern light commercial vehicle assembly plants in Europe. The assembly layout covers an area of 70,000 sq. ft. and has been designed to enable production to be increased with the minimum of alterations to the existing plant and is extremely compact; this has been achieved by designing the assembly lines in a double "S" formation and by including a mezzanine floor for finish painting.

A special feature of the assembly line is the number of anti-corrosive and protective finishes applied to the body shell, the underseal spray being of particular interest, since this is the first time this treatment has been applied to a complete commercial vehicle during production. The treatment consists of a spray Porterite treatment on the outside followed by dip treatment with submerged spray jets to just above floor level. The dipping bath is designed to ensure complete penetration to all parts of the body undergoing treatment. Two coats of spray synthetic primer sealer, wet on wet, are then applied to both outside and body interior, after which the underside of the body structure is coated with underseal. Finally, the bodies can be finished, if required, with a choice of eight attractive monotone colours.

The vehicle is of all-steel construction and an example is shown above. The body shell has been designed so that it can be easily converted into a number of derivatives, including a twelve-seater light bus, fourteen-seater contractor's bus, pick-up, ambulance, caravan, milk-float, gown van, mobile shop, etc. The petrol engine is a four-cylinder o.h.v. 1494-c.c. unit developing 49 b.h.p. at 4,500 r.p.m. and the diesel alternative is a 1621-c.c. four-cylinder Perkins engine of the direct injection type and develops 40.5 b.h.p. at 3,600 r.p.m. As a large number of vehicles will be exported, left-hand steering is available.



*New Commer 1-ton forward control van*

### AN IMPROVED SOLDERING FLUX

TESTS have been carried out by the Tin Research Institute which show that a zinc chloride flux made up with polyethylene glycol has considerable advantages over the normal zinc chloride/water mixture. These are briefly:

- Much less spattering.
- Better spread, since the polyethylene glycol is not volatile, and continues to do its job during heating.
- Much easier cleaning of residues on completion of work. The polyethylene glycol remains as a liquid which immediately mixes with water and is very easily washed away.

### KENT APPRENTICES RECEIVE AWARDS

COMMANDER P. W. Kent, R.N., Chairman of George Kent Ltd. presided at the company's annual apprentice prize-giving and exhibition of work held at Biscot Road Works, Luton, recently. In addition to presenting a large number of prizes for individual successes both in work and studies, Commander Kent reviewed the many collective activities of the firm's apprentices during 1959.

Also present was the deputy chairman of the company, Mr. T. P. W. Norris, M.B.E., M.C., B.A., who as guest speaker addressed an audience which included representatives of local education, industry and employment.

### ENGLISH INDUSTRIAL EXECUTIVES VISIT SWISS ABRASIVES FACTORY

THIRTY-THREE technical executives from the motor, stainless-steel, furniture, radio-cabinet and flooring industries, arrived back in England recently after a trip to inspect the latest abrasive production methods in Switzerland.

Their companies are all old customers of Heddon-Smith (Overseas) Ltd., of Heddonia House, 274, Euston Road, London, N.W.1. — one of the Heddon-Smith (Overseas) group of companies, exclusive distributors of S. I. A. abrasives in this country. The trip was organized

by Mr. R. W. Dreyfus (chairman and managing director) and Mr. G. J. P. Bowser (director).

The latest extension to the factory of Swiss Industrial Abrasives, with its white brick exterior and huge windows, is only two years old and contains the most modern machinery available. Experts explained production methods to the visitors, who were able to see the new development in abrasive production designed to cope with the hard surfaces of polyester finishes, which are almost impossible to sand down by usual methods.

## FREE-WORLD SUPPLIES OF NICKEL REMAIN AMPLE

**I**N giving a review of the nickel industry, Dr. John F. Thompson, chairman of The International Nickel Co. of Canada, Ltd., stated recently, that free world consumption of nickel in 1959 had exceeded 400 million pounds, an increase of 25 per cent. over the 320 million pounds consumed in the previous year, but in spite of this increase and the uncertainties in Cuba, free-world supplies of nickel continue to be ample.

Free-world capacity for nickel production in 1959 was about 550 million pounds from all sources and Canada continued to be the largest supplier, having accounted for over 70 per cent., while Cuba supplied 10 per cent., the United States 4 per cent. and New Caledonia, Japan and other sources, the rest. On present planned programmes, world capacity is expected to increase by more than 100 million pounds annually in the next two years and International Nickel's new mining project at Thompson, Manitoba, which is scheduled to be in full production by 1961, will contribute 75 million pounds to this increase. Next to Inco's operations in the Sudbury District of Ontario this new venture will constitute the largest nickel-producing plant in the world and involve a capital expenditure of 115 million dollars, all which will be borne out of company funds, and a total initial expenditure of 175 million dollars, making it the largest single investment in Manitoba. Referring to other sources, Dr. Thompson stated that the Nicaro plant in Cuba, which is owned by the United States Government, produced 39 million pounds of nickel in 1959, all of which formed part of the normal United States supply. The full production capacity of this plant is about 50 million pounds in the form of nickel oxide powder and sinter and the General Services Administration of the United States Government had offered the plant for sale; responses had been received from private industry and the Cuban Government had expressed an interest in acquiring the plant, although it may be some time before an acceptable sale can be concluded. The United States Government had also made available to industry some of the nickel stock held in the Defence Production Act Inventory; these stocks, which have accumulated since the latter part of 1957, amounted in December 1959 to 137 million pounds of nickel in a number of forms, including electrolytic nickel.

## NEW AMERICAN PLASTIC COATING

**N**EWTON Plating Jigs and Insulations Ltd. have acquired the agency for the South of England and the Birmingham Area for the application of a new American plastic coating applied by the spraying method and dipping process.

Work will be carried out at the Slough factory and will cover the insulation of all electroplating plant and accessories by the spray method to thicknesses required by customers. Items such as refrigerator shelves, wire baskets, dish racks etc. can be coated by the cold dip process enabling drastic cuts in costs to be made.

Leaflets giving further particulars can be obtained from the main works at 13, Stratford Road, Acton, London, W.3. Telephone Acorn 6157.

## NICKEL ALLOYS EXHIBITIONS

**T**HE outstanding success of their previous exhibition held in London prompted Henry Wiggin and Co. Ltd. to stage a similar exhibition at Park Lane House, 45, Park Lane, W.1, from March 21-25, 1960 last.

The aim of this exhibition was to help engineers and designers to make the best use of the specialized alloys manufactured by the Company. These alloys fall mainly into four groups; corrosion-resisting alloys, heat-resisting alloys, electrical resistance alloys and materials with special properties. The display included a large selection of actual components, sub-assemblies, and finished parts in which Wiggin materials play vital roles.

During the exhibition a series of lectures was given on subjects including "Fabricating the High-Nickel Alloys," and a series on the uses of high-nickel and nickel-base alloys in the production of nuclear power, in heat-resisting applications, in the electrical and electronic industries and in chemical engineering.

Throughout the exhibition the company's technical staff were available to answer visitors' queries, and publications covering the complete range of Wiggin products were available. The exhibition was augmented by a continuous showing of films on applications and fabrication of Wiggin products.

## SAFETY IN INDUSTRY NATIONAL IDEAS CONTEST

**M**ORE than £1,000 prize money is being offered by the National Safety Contest for safety ideas to cut down accidents in industry, on the roads and at home.

The Contest (which runs from April 25—May 23) is being sponsored by 35 of Britain's leading companies. The Chairman of the Contest, Mr. R. Reader Harris, MP for Heston and Isleworth, said, "Every hour, day and night, two people are killed, 352 seriously injured and many more slightly injured in accidents of some kind or another. Industry alone is losing something like 20 million man-days a year—seven times more than the country loses through strikes and stoppages. If we could reduce accidents by as little as 10 per cent. we would save the national purse hundreds of millions of pounds."

Messages of support for the Contest have come from both the Ministry

of Labour and the Ministry of Transport as well as from Members of Parliament on both sides of the House.

The industrialists backing the Contest believe that there is a wealth of inventive talent among members of the public—even children. They are seeking simple ideas described in a few hundred words as much as technical entries.

Six finalists will be brought to London and will there compete for a first prize of £500. The second prize is £250, third prize is £150, and there are three consolation prizes of £50. Under 16-year-olds will be eligible for a special prize of £50 and five consolation prizes of £10.

During the month of the Contest nearly 100,000 posters will be displayed throughout the country in offices, public halls, schools, etc.



## COMMONWEALTH TRAINING WEEK TO BE ARRANGED IN 1961

*All Forms of Training for Employment Covered*

AT a meeting in Buckingham Palace in May 1959, it was agreed to hold a Commonwealth Technical Training Week throughout the Commonwealth in 1961 with the object of stimulating awareness of the responsibility of the community towards young people entering employment, and to stress the importance of schemes of induction and training. The meeting was attended by High Commissioners, members of Her Majesty's Government and representatives of the local authorities, and various national and industrial organizations.

The City and Guilds of London Institute undertook central administrative responsibility for the week and in his capacity as president of the City and Guilds of London Institute, H.R.H. the Duke of Edinburgh has approved the decision that in the United Kingdom the date of the week will be from Monday, May

29, 1961, to Sunday, June 4, inclusive; it is hoped that it will be possible to hold the week in other parts of the Commonwealth and that, as far as possible, the same dates will be chosen.

The week is intended to cover all forms of training for employment, including apprenticeship, operative training, and training for commerce, agriculture, the professions etc. and a booklet is in preparation listing activities which might be arranged.

The Institute has written to all county, city, borough and urban and rural district councils in England and to local authorities in Scotland and Northern Ireland, informing them of the date selected and asking them to consider whether they wish to take part in the Week and if so, to decide among themselves the most suitable areas for the purpose and the best way of organizing the week.

## SUCCESS OF THE GRAND BAHAMA INDUSTRIAL DEVELOPMENT SCHEME

*Opportunities for Further Extension of Industry*

THE commercial, industrial and social project started at Freeport on the Island of Grand Bahama in August, 1935, to increase the colony's economic prosperity has resulted in attracting many businesses and light industries to the area. Substantial tax concessions and other trading advantages arranged between the Grand Bahama Port Authority, the developers of the project, and the British Government of the Bahamas present admirable opportunities for the setting up of many kinds of business, including shipbuilding, quarrying, lumbering, electrical engineering, glass manufacture, hydroponic farming, marine engineering and the production of chemical fertilisers. These growing industries have required many new buildings and roads which have prospered those industries concerned. With the development of new commercial and industrial enterprises, the population of Freeport has increased considerably and more and more Europeans, Americans and Bahamians are making their homes

in the Freeport area. There is a good labour force on the island which is mostly unskilled although there is almost an unlimited supply of labour in the British West Indies and broad powers have been granted to the Grand Bahama Port Authority and its licensees to import skilled labour.

One of the first tasks undertaken by the Authority which has the sole right to plan the layout and development of the Freeport area, was to improve the port facilities and as a result Freeport now has a fine deep water harbour covering a million sq. ft. and a channel 200 ft. wide with warehouses and modern cargo handling equipment. Work on the harbour is still proceeding and it is hoped that eventually it will be possible to accommodate the largest vessels. Excellent bunkering facilities are available at Freeport for all types of shipping in protected waters with a minimum depth of 45 ft. and include an 18 in. submarine bunker 'C' pipeline pumping 1000 tons an hour as well as 8-in. diesel and fresh-water pipelines.

## LABORATORY APPARATUS & MATERIALS EXHIBITION TO BE HELD IN JUNE

THE Laboratory Apparatus and Materials Exhibition to be held from June 20 to 23, 1960, at the Royal Horticultural Society's New Hall, Westminster, S.W.1, will be the first ever national show exclusively devoted to laboratory supplies.

Here for the first time, all scientific workers engaged in laboratory practice, including members of hospital and university staffs, research workers, laboratory supervisors, chief chemists and heads of scientific departments in industry can inspect every possible laboratory requirement in a single exhibition.

Although the Exhibition was announced to the trade late in 1959, a rush of early bookings has already confirmed the great need for a specialized showing of laboratory supplies. Four months before the opening date, the Organizers announced that only 8 stands were available.

The number of scientists and technologists now engaged in scientific and industrial research is greater than ever before, and for most industries a well-equipped laboratory is essential for development and expansion.

A programme of special lectures is being arranged concurrently with the Exhibition. Papers on various scientific subjects will be read by acknowledged experts in their fields, and it is also planned to hold film shows dealing with aspects of laboratory work, and demonstrations of various techniques.

W. and S. Summerscales Ltd. of Keighley are now manufacturing a new combined washing machine spin-dryer, the Scales Doublespin, in which white tweed-finish Stelvetite plastic-coated sheet steel is used for the outer casing.





## TECHNICAL BOOKSHELF



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The address, telephone numbers, directors and management remain unaltered.

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Mr. James K. Hossack

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From the Register compiled by Jordan & Sons Ltd. 16 Chancery Lane, London, W.C.2.

## TECHNICAL and INDUSTRIAL APPOINTMENTS

Mr. S. W. Vickery, chairman and managing director of **Ferro Enamels Ltd.**, Wombourne, Wolverhampton, announces the appointment of Mr. James K. Hossack as general manager.

Mr. Hossack was born in Montreal in 1915, and has been with Ferro Enamels (Canada) Ltd., for the past 25 years. He is a past president (1955) of the Canadian Ceramic Society.

At the age of 36, Mr. Hossack was appointed vice president of sales and service at the Ferro plant in Oakville, Ontario and for the past eight years he has specialized in administration and marketing.

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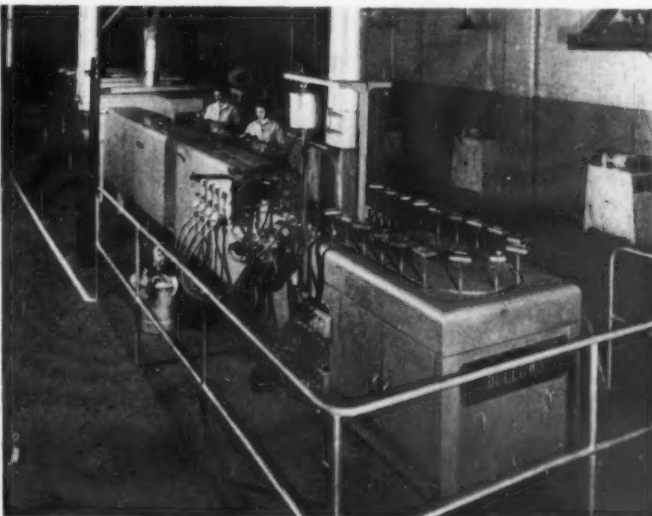
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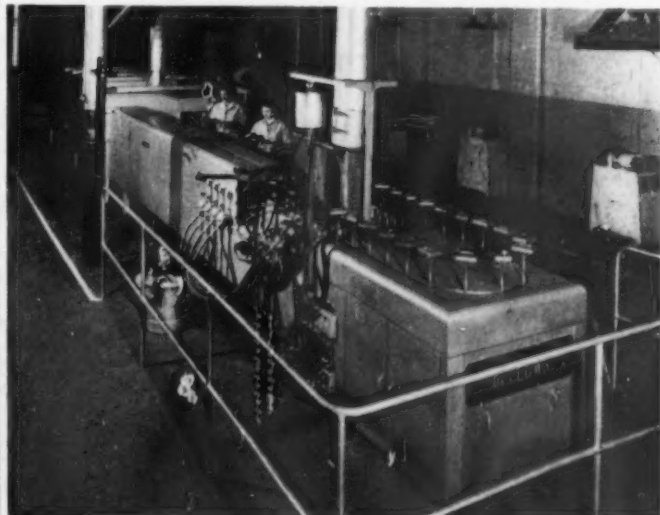
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The British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1., have produced a booklet "Better Plating on Die Castings" in which discussions are offered on modifications to plating technique required to overcome the deterioration of chromium plating, particularly on motor cars, which has led to a certain amount of criticism in recent years. Many of the components are made from zinc-alloy die castings and these have been specially mentioned since corrosion results in permanent disfigurement of the plating by blisters.

One of the reasons for the breakdown of the plating is that too thin a deposit of nickel under the chromium is used and the latest British Standard calls for nearly double the thickness of nickel formerly specified, although under the severe test of day-to-day exposure to a polluted city atmosphere it is found that additional protection is required.

The approach made by the British Non-Ferrous Metals Research Association is to improve the surface coating of chromium, and take advantage of the high corrosion resistance of chromium. Up to now only a very thin coating of chromium has been used (about 0.00001 in.) relying upon nickel to provide corrosion resistance, the main reason being that thicker deposits of chromium tend to crack and lose their protective value.

Research has shown that this difficulty can be overcome and the booklet illustrates that the corrosion resistance offered by the thicker chromium plating is remarkable even though it is still below 1/10,000 in. thick. The booklet is available from the Association price 7s. 6d.

"Finishing Facts" for January, 1960 issued by the Imperial Chemical Industries Ltd., Paints Division, Slough, contains an article describing the pretreatment and stove-enamelling of the Flatley household laundry drier. The degreasing plant consists of an I.C.I. trichloroethylene plant 30 ft. long, 6 ft. 6 in. wide and 13 ft. 3 in. high and from this the products are carefully tack-ragged before being conveyed to a dry-back spraybooth where the interior is painted, by an airless spray, with "Dulux" Stoving Enamel F. 652; they are then taken to a Ransburg No. 2 electrostatic spray installation where the exteriors are automatically sprayed with Dulux Stoving Enamel F.652 and then transported into the stoving oven of 104 gas-fired radiant panels built into a length of 52 ft. which rapidly raises the temperature of the components to 500°F., the conveyor

## Trade and Technical Publications

speed of 9 ft. per minute giving them approximately five minutes stoving.

The pamphlet contains other articles on subjects such as car finishes and one on the use of gas chromatography in a wide field of research including day-to-day analysis.

Electronic Switchgear (London) Ltd., of Letchworth, Herts, have issued the first of their data application sheets D.S.160 which deals with the control of detergent strengths in wash waters for bottle and dish washing machines, textiles, electroplating washers, etc. The principle employed is based on the continuous automatic measurement of the electrical conductivity of the washing solution which varies widely in direct relation to the detergent concentration. When the conductivity of the solution changes to a value equivalent to the minimum satisfactory detergent strength, a relay in the controller operates a solenoid valve which admits sufficient fresh detergent to the solution to restore optimum concentration.

In "Careers and Training" issued by Wilmot Breedon Ltd., Amington Road, Birmingham, this company describes the various training schemes including craft apprenticeships, engineering, scientific and commercial apprenticeships, university-degree courses and executive development by which it very wisely pursues its aim to ensure a steady flow of young people to fill appointments over the whole range of its needs and to ensure a co-ordinated practical and theoretical pattern of instruction appropriate to their chosen profession or trade.

Two of the most important activities of the Wilmot Breedon companies are mechanism design and electro-plating and in these fields they make valuable contributions to the motor industry, the manufacture of domestic appliances and the manufacture of aircraft and aero-engines. The booklet is very well illustrated.

"Designing for Chromallizing" is the subject of a new 2-page bulletin available from Chromalloy Corporation, White Plains, N.Y. The illustrated bulletin lists "do's and

don'ts" for parts to be chromallized—a method of surface alloying which improves heat, wear, and corrosion resistance of metals and refractories.

Drawings show proper radii and bending of corners to ensure smooth, finished surfaces. Good thread design is likewise illustrated. Also, two schematic diagrams compare a chromallized part with one coated by conventional means such as painting, plating, metal-spray, or vacuum-coating. The diagrams show the apparent growth of the metal part due to surface diffusion of the chromium and other alloying elements, and the generation of a highly resistant case.

A free copy of Bulletin 40 is obtainable from the Chromalloy Corporation, 452 Tarrytown Road, White Plains, N.Y.

"The Bonderizer," February to March 1960, issued by The Pyrene Co. Ltd., Metal Finishing Division, Great West Road, Brentford, Middlesex, opens with an article on the new low-temperature "Spr-Bonderite" 115 process recently installed on one of the motor-car lines at the Cowley Works of the Pressed Steel Company Ltd., to meet the demands there for a zinc phosphate process using solutions containing no sodium salts. In the Spr-Bonderite 115 process, the free acid in the solution is controlled by metered additions of a solid zinc salt, thus ensuring the absence of soluble sodium salts from the processing solution. The process entails automatic additions of concentrated "Spr-Bonderite" 115 chemical, hydrogen peroxide and the special neutralizing zinc salt to the processing tank. Once the correct rates of replenishment have been established, uniform Bonderite coatings can be produced within the low temperature range of 100-110°F. The pamphlet also includes a description of the semi-automatic fully conveyORIZED "Bonderizing" plant at the Cambridge Works of Marshall Motor Bodies Ltd., for the treatment of Service fighting vehicle bodies, believed to be the most comprehensive of its type in the U.K. and probably the world. Bonderizing is the term applied to the processes for bonding paint to iron, steel, zinc, cadmium and aluminium surfaces.

## ***Latest Developments*** ***in***

## **PLANT, PROCESSES AND EQUIPMENT**

### **Automatic Metal Spraying**

THE METCO Type C control system produced by the Metallizing Equipment Co. Ltd., Woking, is a fully automatic electronic control unit for heavy-duty or production metallizing. The control unit (Fig. 1) is built on the module system to give maximum flexibility in the degree of control required and will operate with both wire and powder metallizing processes. For wire spraying the control unit is used in conjunction with the company's Type K metallizing gun and, for hard-facing applications, using tungsten carbide, Ni-Cr. alloys and ceramics, with the Thermo-Spray gun.

The design of this control system has been made as flexible as possible and units can be readily added to the basic assembly to meet special requirements for any given metallizing operation.

Failure of electric power, compressed air, gas supply, wire feed, dust extraction, or failure of the mechanical handling of the component, can shut down the entire system and indicate the appropriate failure.

### **Electric Motors**

A NEW range of totally enclosed fan-cooled motors which are claimed to be smaller, lighter and cheaper than existing motors of the same type is announced by the English Electric Co. Ltd., Marconi House, Strand, London, W.C.2. The dimensions of the new motor are exactly the same as the 'C' type ventilated motor (British Standard 2960) and the two types are, therefore, interchangeable.

The new motors, called type 'D,' have outputs up to 100 per cent greater than existing motors of the same size, type 'B.' For example, a 40-h.p. 'D' type motor is now manufactured in the same frame size as the previous 20-h.p. 'B' type. The greater outputs have been achieved by allowing for a temperature rise of 65°C. above 40°C. instead of the existing 55°C. This results from the use of class 'E' insulation instead of class 'A.' These new motors are designed for wide industrial application, particularly where there is dust and dirt in the atmosphere. Special versions, having internal and external anti-corrosion treatment, will be produced for the chemical and gas industries.

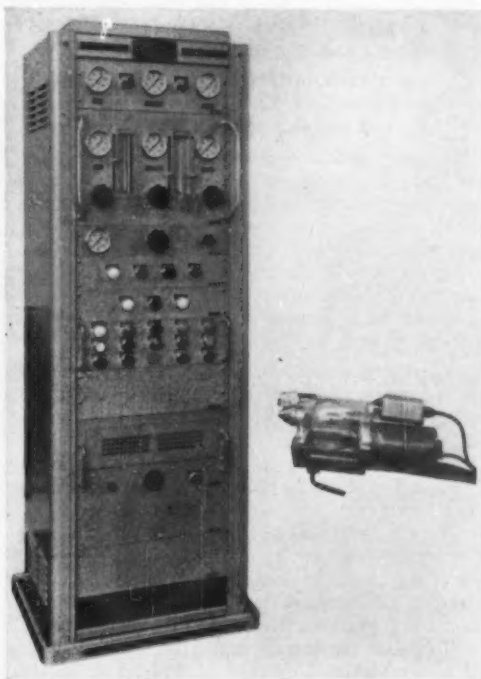


Fig. 1—Control system for metal spraying

### **Heat Seal for Hot Processing Baths**

THE Pyrene Co. Ltd., Great West Road, Brentford, Middlesex, have introduced a new treatment, "Heat-Lok," which provides a protective chemical blanket for hot immersion processing baths.

The treatment consists of two integral components, one forming a protective blanket on the surface of the processing bath, and the other a surface-activating agent in the processing solution itself. It is claimed that as surface evaporation is almost eliminated, there is a saving in heating and the maintenance of heating elements. In addition, since corrosive elements are blanketed and held within the bath, corrosion of nearby equipment is minimized.

### Acrylic One-coat Enamel

**A**N acrylic one-coat stoving enamel which, it is said, will increase productivity and cut production costs is now being manufactured by Lewis Berger (Great Britain) Ltd., Dagenham, Essex.

This new enamel—Bergercron—is claimed to be very hard and flexible; it has a high resistance to heavy impacts, acids, stains and corrosion, and its high gloss, depth of finish and smooth appearance make it ideal for domestic appliances such as refrigerators, washing machines, and cookers.

It is also suitable for steel office furniture, the strip coating and container industry, air-conditioning plant and hospital and medical equipment.

The new enamel will withstand heavy handling and service conditions as well as extremes of temperature and humidity, and it combines an excellent flow with a fast rate of set, reducing the tendency to sags and runs. Its properties are said to be beneficial in electrostatic application in which process feed rates up to 1100 cc. per min. can be obtained. The enamel also has good can stability and has a wide margin of safety in storing.

In order to compare the performance of the new enamel with other types of finishes, the manufacturers carried out tests with three other finishes in general use, *viz.*:

- (i) An alkyd resin amino finish especially formulated for good flexibility and colour retention.
- (ii) A different alkyd resin amino combination—reinforced by epoxy resin giving a good all-round performance.
- (iii) A finish based largely on epoxy resin stoved at higher temperature and having especially good hardness, humidity and detergent resistance.

They stress that the reported high performance with Bergercron is obtained by direct application to steel, aluminium and zinc alloys, etc. without primer. With the alkyd-type finishes a primer is invariably used, requiring double application and double stoving operations.

A simple method for assessing hardness suitable both in the laboratory and on the production line is to use a range of ordinary pencils varying in hardness from a soft, such as 2B to 2H for very good hardness. By this method a very good finish has a rating of 2H, a rating of 3H is exceptional; Bergercron claims 5H and can be developed to 7H.

This extreme hardness, coupled with good adhesion and flexibility, has advantages for the production manager, giving fewer rejects and spoilt work caused by accidental damage. Detergent-resistance and humidity resistance are, of course, prime requirements for washing machines, spin

dryers and dish washers. Tests have shown that the new finish is unaffected by

1. Exposure for 1000 hours at 95 to 100°F. and approximately 100 per cent relative humidity.
2. Complete immersion in water for 4000 hours at 100°F.

The resistance to a standard detergent solution, 2½ per cent concentration at 160°F. for 48 hours, is said to be quite outstanding, and after immersion in a boiling detergent solution it is unaffected after 30 minutes.

In factory operations it is necessary for finishes, especially white, to withstand double the normal stoving operation or sometimes accidental stoving at higher than normal temperatures, without showing discolouration or loss of gloss; in this respect Bergercron is claimed to be exceptional and provides a valuable margin of safety in factory finishing operations. The considerable number of manufacturers of domestic appliances who are currently testing Bergercron in the laboratories and on production trials are confirming these findings.

The new finish is normally stoved at 350°F. for 30 minutes, a schedule quite comparable with that required for high-quality epoxy finishes but slightly higher than the normal schedules for alkyd-resin-type finishes. Recent work has shown, however, that by appropriate technical modification this temperature can be reduced to 300°F. without any sacrifice of these essential properties.

This ability to withstand stoving at very high temperatures without discolouration or detriment to the finish can be used to give additional overall savings in production costs. Assuming that a normal stoving schedule is 350°F. for 30 minutes, then by stoving at 375 to 380°F. the processing time can be halved.

For other industries such as strip coatings and can coatings very short times at 400 to 500°F. can be used, and the ultimate has been reached for a special application on steel razor blades where by flame-curing at temperatures of 1000 to 1200°F. the finish is cured in 4 to 5 seconds, the blades then withstanding 2-minutes' immersion in boiling water without damage.

Application can be made by all normal methods; spray, dip, roller coat and flow coating. Physical properties can be varied to provide maximum corrosion resistance and durability or extreme flexibility such as required in the fabricating operations of the container industry.

### Quick-Drying Primer for Metals

**A**RTUR Holden and Sons, Ltd., Birmingham, have produced a new general-purpose grey primer which, it is claimed, dries in 10 minutes and can be applied to most metals and even hardboard.

(Continued in page 164)



**SBSF**  
Uses a new sulphur-free addition agent with excellent levelling characteristics. A very ductile semi-bright deposit is produced at high current densities.

**Plusbrite Duplex**  
A process combining SBSF and Plusbrite Nickel to produce a fully bright finish combined with excellent corrosion-resistance and ductility.

**Plusbrite Nickel**  
Addition agents for fully bright nickel plating that provide high ductility, excellent levelling, low internal stress, good colour, and good receptivity to chromium plate.

**Nickel Sulphamate**  
An electrolyte based on Nickel Sulphamate makes very high current density plating possible, producing thick deposits in a short time. Deposits have low internal stress and are extremely ductile.

**Service to nickel platers**

The Metal Finishing Department of Albright & Wilson (Mfg) Ltd is able to offer an extended range of chemicals and processes and an efficient technical service to platers throughout industry.

FULL INFORMATION FROM: **Albright & Wilson (Mfg) Ltd**

Metal Finishing Department 1 Knightsbridge Green, London, SW1  
Telephone: Kensington 3422

Steel, aluminium, Mazak, Zintec, copper and brass may be dipped, sprayed or brushed with the new product which should reduce production times with its high drying speed.

For handling in 10 minutes and over-coating within an hour, the new primer accepts as a second coat, air drying industrial finishes, synthetic stoving enamels, stoving hammer finishes, cellulose lacquers shrivel enamels and even decorative paints.

It will take, in addition, epoxy-based heat-resisting stoving enamels. The new primer also provides anti-corrosion protection over several months without breakdown for materials and products subjected to outdoor exposure.

#### New Tack Rag Development

**D**URING the period January-June 1959, Anti-Dust Services 53a, Stafford Street, Dudley, Worcs., produced nearly 750,000 standard size A.D. Tacky Rags, using two different cloth specifications and three different formulations for a range of four tack-rags of different characteristics.

Research into the requirement of an ideal tack-rag have shown that a new process was required to meet these requirements and for this purpose a new plant has been built to manufacture 19,000 daily of a new "Painter's Tacky Dusters" which will bring their total output up to 25,000-30,000 daily.

The new tack-rag is claimed to be free from residual solvents, drying or semi-drying oils and volatiles of any kind, which can evaporate in storage and use, provide a flashpoint to the tack-rag similar to that of the solvent and a basis for spontaneous combustion at elevated temperatures. Since the dusters are unaffected by the hardening process associated with the evaporation of solvents they retain their original qualities of pliability and dust absorbance.

As smearing with a fresh tack-rag is not always avoidable the medium with which the new tack-rag is impregnated has been designed so that it is assimilated by a large variety of surfaces coatings representative of those used in industry.

#### Phosphorescent Paint

**A**LLWEATHER Paints Ltd., 36, Great Queen Street, London, W.C.2., have produced a phosphorescent surface coating for use under conditions of poor lighting and hours of darkness to allow protruding structures, signs, obstacles in or near passages etc. to be seen more readily.

"Pitan" phosphorescent coating, as it is termed, can be used with a suitable primer or sealing coat. It is available in a basic pale green colour, is

suitable for brush application only and covers at the rate of 20 square yards per gallon.

Another preparation, using day-glowing pigments and for which there are obvious applications available, is "Pitan" fluorescent coating, which has a covering capacity of 30-40 square yards per gallon and is available in the following colours :

Orange,	Red,	Green,
Cerise,	Pink,	Chrome Yellow
Lime,	Bright Red.	

#### Packaged Oil-Gas Plants

**T**HE Incandescent Heat Co. Ltd., Smethwick, report the development of a new process for the gasification of petroleum oil. The process is continuous and does not employ catalysts. Cracking heat is supplied by burning oil and waste products in a compact and simple furnace setting. The oil to be gasified is injected together with steam into a system which is specially designed to enable a uniform and precise control of cracking temperatures to be exercised. By these means the production of unwanted by-products (particularly carbon and tarry condensates) can be kept to a minimum; more particularly the calorific value of the gas produced can be varied continuously in the range 500 to over 1,200 BTU's per cubic foot. The gas is interchangeable with natural gas or coal gas of similar calorific value. Results obtained with a heavy distillate oil indicate that this system can be operated economically over a wide range.

#### Bench-mounted Grinder

**A**N air-operated grinder for mounting on work benches has been introduced by the Consolidated Pneumatic Tool Co. Ltd., of 232, Dawes Road, London, S.W.6.

The new grinder, known as the 3190M has a 6-in. dia. wheel which has a width of 1-in. the free operating speed being 4,500 r.p.m. The total height of the unit is 9.1/16-in. and the weight, including the guard, is 12 lb. The diameter of the air inlet connexion is  $\frac{1}{2}$  in. this being a male B.S.P. thread.

Power for the tool is developed by a vane-type motor, particular features of which are the constant-speed governor which maintains the wheel at the most efficient cutting speed from no load to full load and eliminates the possibility of overspeed when running free, a heavy valve spring and loose fitting valve which prevents the valve from being jammed by foreign matter and a neoprene "O" ring which gives a leakproof valve seal.

(Continued in page 26)



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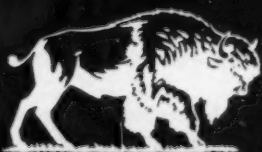
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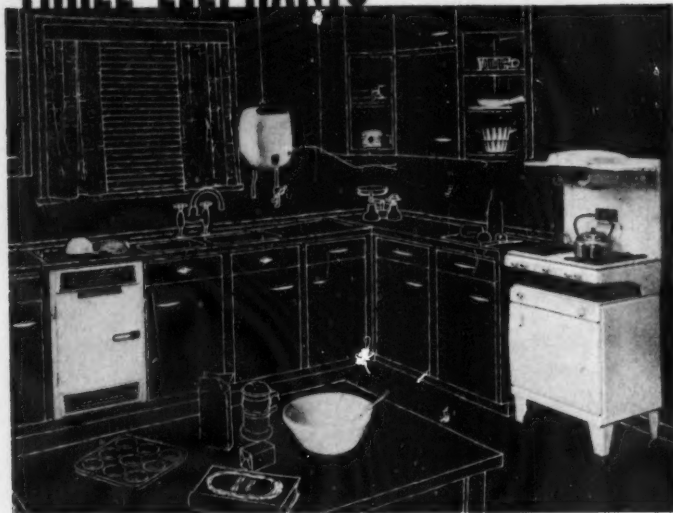
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### Plant, Processes and Equipment

(Continued from page 164)

#### New Shape Nickel Anodes

THE Hanson-Van-Winkle-Munning Company, Matawan, New Jersey, U.S.A., have produced a new-shape nickel anode which they claim features less proportionate scrap loss per anode and longer runs between replacement periods. The new shape anode is called Econ-O-Shape and will be marketed in a new-type anode shipping container to minimize damage in transit.

#### High-Temperature Tunnel Kilns

FERRO Enamels Ltd., of Wombourne, Wolverhampton, have extended their previous range of small, special-purpose high-temperature car-type tunnel kilns (range 800°C. to 1400°C.) for the electronics, ceramics and other industries, by the introduction of a range of sliding-plate tunnel-type kilns, sizes 15 ft. to 60 ft. and temperatures 800°C. to 1400°C. They are heated by elements placed under and over the charge, which is particularly suitable for charges of low setting height where stacking is to be avoided; the car-type of furnace is heated by elements radiating at the

side of and underneath the charge and has its particular application in relatively heavy loads or for larger outputs where the charge can be stacked several pieces higher.

Both types of kiln are prefabricated for easy sectional assembly on the job and with their range of temperature application and low time cycle of operation are suitable for a wide variety of uses.

#### Protection for Aluminium Surfaces

SWALE Chemicals Ltd., 53, Park Hill Road, Croydon, Surrey, have produced a tough highly decorative range of epoxy-based lacquer finishes for aluminium, termed "Lakadize EPO," which compare very favourably, they claim, with electro-chemical processes.

These finishes in light-fast, high-gloss colours are suitable for a wide range of articles such as kitchen-ware and industrial components made of aluminium and no special equipment is required beyond ordinary paint-shop plant.

The lacquer is applied by dipping or spraying, but as it is a transparent coating the surface must clean and uniform in appearance. After application Lakadize EPO must be stoved for 20 minutes at 170°C.

(Continued in advt. page 27)



## Classified Advertisements

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### SITUATIONS VACANT

#### IMPERIAL SMELTING CORPORATION LIMITED

A VACANCY exists in the Metal Finishing Laboratory of the Physical Metallurgy Section of Research Department for a

#### METAL FINISHER

Applications are invited from Chemists or Metallurgists possessing a degree in either of these subjects or a Higher National Certificate with some experience in the metal finishing industry. Duties will involve work on metal finishing problems relating to zinc and its alloys, corrosion testing, and liaison with Technical Sales Service.

Applications, containing details of qualifications and experience, should be submitted in writing to Personnel Manager, Imperial Smelting Corporation Ltd., St. Andrew's Road, Avonmouth, Bristol, quoting ref. MF/MFJ.

#### A growing concern in the field of ELECTRO PLATING AND POLISHING in Stoke-on-Trent have an attractive vacancy for a WORKS MANAGER

to take full charge of their factory. This is a post with future prospects for a man with sound previous managerial and technical experience in this specialised field, who has drive and initiative. A good commencing salary will be paid and bonus on results is contemplated after a probationary period.

Applications with fullest details of past experience, and stating salary requirements should be submitted to:—  
**A. G. Hayek & Partners Limited,**  
Management Consultants and Industrial Engineers,  
Federation House, Stoke-on-Trent.

**SALES REPRESENTATIVE REQUIRED** by Supply House Electro-Plating and Polishing Trades. Area to be covered will include Bristol and Southern England. Applicant should reside in, or around, Bristol. Connection already established with great potential for expansion. Should be keen and prepared to work hard. Salary, Commission and Expenses paid. A car will be provided by the Company. Apply: Sales Manager, Box. No. SR 225.

### PATENT

**Patent No. 767,399** entitled "Method of Manufacture of Protective Surfaces for Metal, Wood, etc." is for sale or licence. For details apply to Chatwin & Company, Chartered Patent Agents, 253, Gray's Inn Road, London, W.C.1.

### MACHINERY WANTED

**WANTED**—Centreless Polishing Machine also Plate Polishing Machine. Apply Box No. W.C.226 METAL FINISHING JOURNAL.

**I.C.I. POPULAR DEGREASER** wanted (Larger Models considered) Preferably gas heated. Must be in good condition. Offers to Fisco Limited, 602, Seven Sisters Road, South Tottenham, N.15.

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**COMPLETE ANODISING PLANT.** Transformer, Davensett Rectifier (20 volts 300 Amps), plus various lead lined, rubber lined and mild steel tanks. Also 7 stainless steel tanks suitable dyeing (2 gas heated). G.B. Fasteners Limited, Conington Road, Lewisham, S.E.13. Lee Green 9971/2.

### Plant, Processes and Equipment

(Continued from page 166)

#### Extra Paint Spray Gun Cap

A NEW internal mix air cap that is claimed to allow a faster rate of paint spray application is now being supplied as standard with the "Tuffy" lightweight utility spraying outfit recently introduced by The Aerograph-DeVilbiss Co. Ltd., 47, Holborn Viaduct, London, E.C.1. This new cap, (Fig. 2) combined with the outfit's portability and ease of maintenance, is useful for general painting and decorating and for refinishing where higher speeds are needed and where the materials used require pressure feed. When a large volume of paint has to be applied to a wide surface area, the outfit can be used with a pressure feed tank 2-gal. capacity together with the necessary fluid and air hose connections. An additional cap supplied with the outfit is for either suction or pressure feed, giving a finer spray and a narrower pattern, for intricate retouching and similar jobs. Changing over the caps is a simple task, requiring no tools.

Fig. 2—Spray gun cap





single operation degreaser,  
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Tell you more about any or all of them? We would be happy to if you write or telephone us.

Euron removes oil and grease, destroys rust and oxides, inhibits further rusting by complete passivation. More than that Euron etches the metal surface to a micro-structure—provides a strong and permanent key for paint. It is suitable for iron and steel, aluminium and other non-ferrous metals. Euron is not only efficient, but also economical, for its fast working rate results in time and labour saving.

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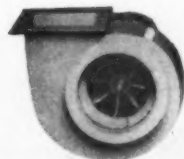
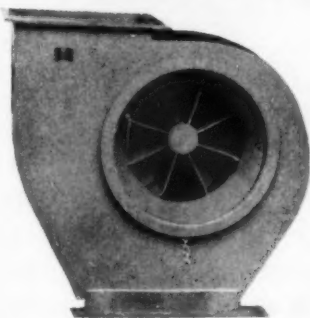
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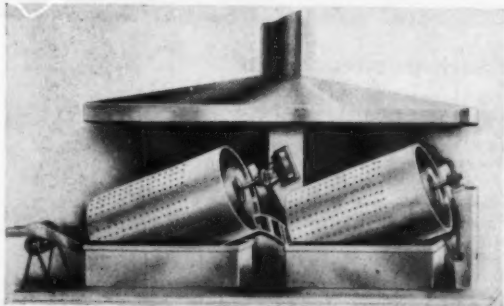


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is  
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good —  
VERY GOOD  
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job...

newcomers ...



to

### Alkaline Cleaner No. 527

A moist white powder readily soluble in water, containing alkaline detergents, hydrocarbon solvents and low foaming surface active agents. A heavy duty soak or spray cleaner for ferrous metals, copper, and magnesium.

the

### Alkaline Cleaner No. 630

A moist cream coloured powder, readily soluble in water, consisting of alkaline detergents, organic surface active agents, hydrocarbon solvents and rust preventatives. A medium to heavy duty cleaner for ferrous and non-ferrous metals as a spray cleaner.

range

### Alkaline Cleaner No. 501D

A dry dust free mixture of buffered alkalis, water softening agents and low foaming wetting agents, a mild, medium duty alkaline cleaner for aluminium, zinc alloy, brass and ferrous alloy base metals, applied by spray or immersion.

of

### Alkaline Cleaner No. 565

A dry tan coloured mixture of alkalis, water softening agents and high foam wetting agents. It is a heavy duty cleaner, suitable for immersion cleaning of ferrous metals and alloys.



metal cleaners

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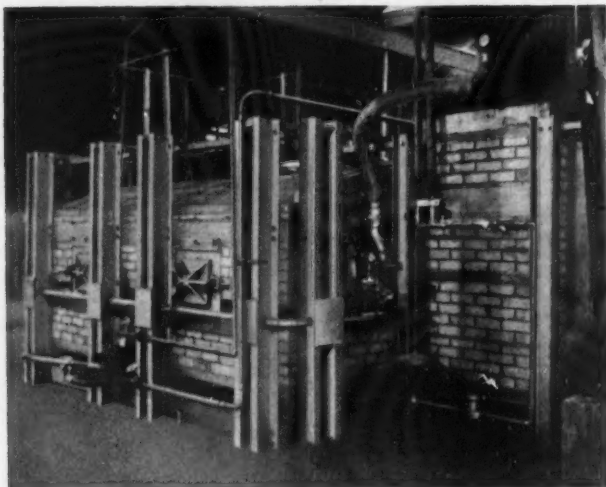
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